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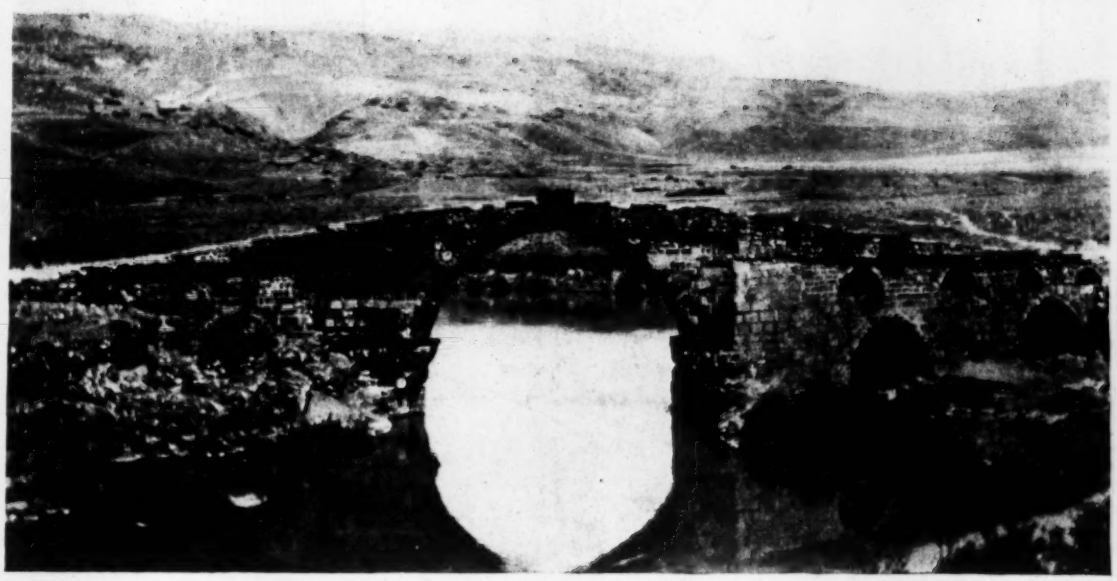

Palestine Bridge, Antedating the Christian Era, Still in Service

FEW engineers have designed a dirigible airship, but as time goes on the number will increase. Meanwhile as a part of his necessary general information, if not as a guide to his own future practice, the engineer should know how these monster rigid structures are fabricated. The intensely interesting story of how the Navy's new 700-ft. dirigible, the ZR1, is being built will appear in the August 9th issue of *Engineering News-Record*. An authoritative account of one of the early adventures into a new field of structural engineering.

In This Issue:

Highway Problems and Progress in the Mid-South:
The Two Virginias
An Editorial Review

Report on the Recent International Navigation Congress at London
By Capt. Frank T. Chambers, U. S. N.

Excavation Methods and Costs
By G. D. Clarke

In This Issue:

Undiscovered Substratum of Peat Causes General Subsidence of Westinghouse Building in Philadelphia

also

Monthly Prices of Construction Materials

Engineering News-Record Construction Cost and Volume Index Numbers

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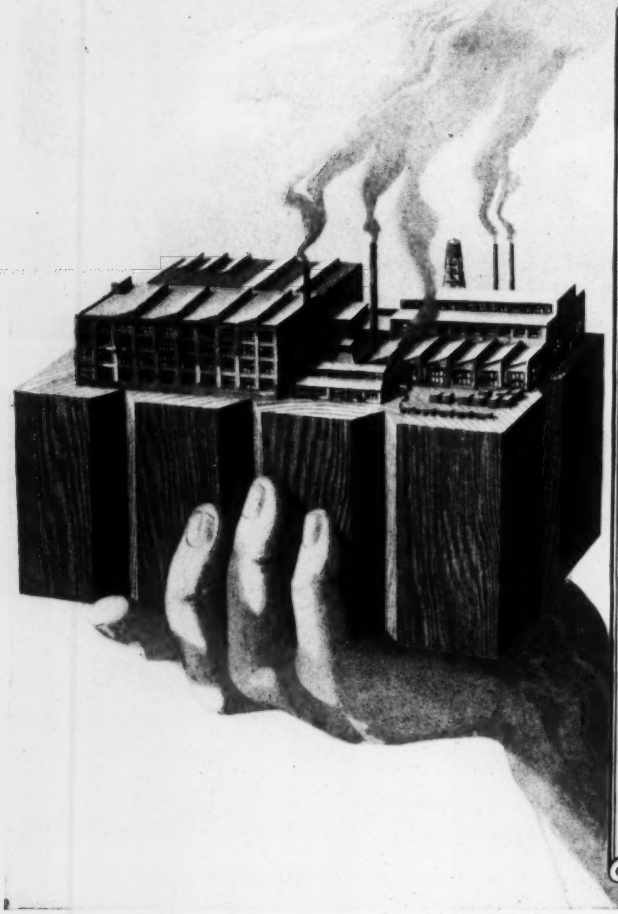

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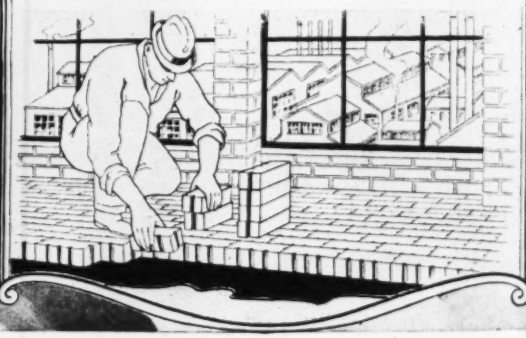

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ENGINEERING NEWS-RECORD

DEVOTED TO CIVIL ENGINEERING AND CONTRACTING

E. J. Mehren, Editor
Frank C. Wight, Managing Editor

Volume 91 — NEW YORK, AUGUST 2, 1923 — Number 5

The Next Step in Coal

AS THIS is being written it looks as though the leaders on both sides of the anthracite coal industry are going to put to the test the implied threat of government control that was the main feature of the recent report of the President's Coal Commission. Perhaps this is as good a time as any to have this happen. The foresighted consumer, after the hardships of last year's coal shortage, has filled his bins; bituminous production has been heavy and the possibilities of soft coal and other substitutes for anthracite have been given such wide publicity that the user will be more friendly to their use than ever before. If the continued ultimatums and suspensions of conference are merely the usual jockeying of trade and international disputes, the public can wait for a solution without government interference. If, on the other hand, collective bargaining has failed in the anthracite industry, let us proceed at once to the distasteful, but necessary, experiment with government intervention. People are going to get coal when they need it and at a fair price and are willing to try any reasonable scheme which will bring about such a result.

Governmental Accounting

THE net operating deficit of the government-owned and operated Alaska R.R. for the year 1922 was over $1,053,000, and since operation started in 1915 the total operating expenses have been nine and one-half million against a total operating revenue of two and one-half million, leaving a deficit of slightly over $7,000,000. In view of a reduction in operating expense of $100,000 and an anticipated increase in revenue of $200,000, the deficit for 1923 is expected to be reduced to $700,000. But there is an item of annual cost which is not included in this governmental statement. That is the interest on the money expended in building the railroad. According to the Department of the Interior, the average cost per mile of the railroad was approximately $84,000, or a total of something over $40,000,000, which amount at only 4 per cent interest puts the actual deficit for the year 1922 at about $2,600,000. These facts are not necessarily condemnatory of the proposition of a government railway in Alaska for obviously no private capital would have gone into this country to open it up without large government grants, and it is highly probable that such grants in a country of vast possibilities in undiscovered mines and great timber resources would have had a value far in excess of the actual capital expenditure made for the privately built railroad. But they do furnish an example of the government method of accounting to the people for the cost of government operation. The figures made public usually account for the actual annual cost of operation and nothing is said concerning the mounting public debt made up largely of capital expenditures on these government projects. On such undertakings as the Panama Canal and the Alaska R.R. the national benefit forms a large item on the credit side of the ledger but the analogy cannot be carried too far in other prospective government work.

Law Requires Day-Labor Costs

ADVOCATES of force-account contruction have an opportunity in the new Breed day-labor law in California to demonstrate their long-urged claim that work done directly costs less by the amount at least of the contractor's profit. By this new legislation all persons proposing to perform public work by day labor are required to file accurate plans and specifications, to record the names of bidders and the prices bid, and to report complete costs of the work and all changes from the plans and specification on file. In the past most argument for or against force-account work has been inconclusive because no cost measure was available for comparison with contract prices. It has been shown in numerous cases and particularly in the investigation by Leonard Metcalf and Harrison P. Eddy a decade ago into Boston city-force-account construction, that rarely are all cost items included in the records. On the other hand in such undertakings as the Panama Canal and the Los Angeles aqueduct, both built largely by day labor, there is reasonable evidence that the method was as cheap as any other, and, in addition, the adminstration difficulties were greatly reduced. There is such allurement in the thought of eliminating the contractor's profit that popular support can be had to almost any proposal to build public works by day labor. It is hard for contractors to meet this situation by argument because whatever they urge is regarded as prejudiced and, as already said, no costs are available against which they can oppose bidding prices. The new California law puts no obstacles in the way of day-labor methods but it does demand that the people shall be told how much they cost as compared with prices for which contractors were willing to perform the work. Contractors have every reason to be gratified with the new legislation.

"A Passion for Straight Lines"

A FEW weeks ago the New Orleans *Times-Picayune* worked itself into a fine frenzy of protest because in the reconstruction of the East Beach road along the gulf shore at Biloxi, Miss., "stately oaks, growth of hundreds of years, are being sacrificed to an engineering passion for straight lines." To one who knows the beauty of the Biloxi drives, the topography of the gulf coast and the engineering principles that govern modern road construction it seemed unlikely that any such vandalism was being committed but it was thought worth-while to make sure. Now comes word from Edmund Friedman, the resident engineer on the work, that "in a total distance of three miles, eleven trees were cut down, of which only four were sound and of

the four two were directly in the center of the road and the other two so near other trees as to prevent the location of an 18-ft. roadway between." And Mr. Friedman adds: "We realize the beauty of a winding road through trees, especially on a beach front, and have really sacrificed the paving to the trees, instead of the reverse." A small and local matter, perhaps some will say, but it deserves to be emphasized, especially as the *Times-Picayune* has not seen fit to retract or explain its misguided campaign. Every such thoughtless attack makes it harder for engineers to get across to the public that they are solicitous of the amenities of life and not materialists who worship only the practical and who go out of their way to sacrifice beauty to a "passion for straight lines."

Legalizing Licensing

EARLY appeal and a higher court decision on the constitutionality of the Pennsylvania engineer licensing law is most desirable. Judge Shull's interpretation of the law, as outlined on another page, might readily apply to most of the similar laws in other states and if these laws are not in accordance with state or federal constitution, engineers want to know it. The interesting thing in the Shull decision is not that an engineer's licensing law is inherently unconstitutional but that, as written, most of them are. On the basis of the decision a valid law could readily be framed by separating engineers and surveyors and by refusing exemption to any class of engineers. There is a chance for argument as to whether or not an engineer's license law is desirable; certainly there should be no doubt that, with proper provisions, it can be made legal.

Adobe Makes Stable Subgrade

A METHOD of handling adobe soil so as to assure stable foundations for paved roads appears to have been determined with some certainty by the tests of the Pittsburg road near San Francisco. In the final report of these tests, just issued, three of the seven conclusions reached by Lloyd Aldrich and John B. Leonard, engineer in charge and assistant engineer, respectively, relate to results secured from the adobe soil subgrade prepared by sprinkling and rolling the pulverized earth in layers. Not only did this treatment give an unyielding subgrade from the notoriously unstable material of which it was constructed but it is asserted that it gave results superior to broken stone sub-base and also showed remarkable resistance to the absorption of moisture from flooded side ditches. Swelling and cracking, the characteristic behavior of adobe when wet and dry, appear not to have occurred. These determinations are of great practical importance particularly in the light of the statement that the method of preparing the subgrade involved comparatively little increase in cost over prevailing methods. Altogether the determinations at Pittsburg on pavement action were relatively unimportant. Though not negligible the pavement determinations were chiefly confirmatory of the results obtained by the Illinois Division of Highways in testing the Bates road and by the Bureau of Public Roads engineers in the tests at Arlington Farm. On the contrary the adobe subgrade results are original and independent contributions to the research information on road construction.

Some Problems of Negro Migration

THE present migration of negroes from the South to the North is a matter of concern for both sections. Exact figures are not available, but scattered data show that there is going on now a greater movement of negroes away from the South than ever before. That section of the country naturally is alarmed over this depletion of its major labor supply, both for agriculture and industry, while the North, except for those centers that are clearly gaining useful and needed common labor, is not thinking much about the question. To most of those who have given the negro migration any thought at all this movement of population has been considered chiefly, if not wholly, a matter of labor supply; but there are other and possibly more far-reaching effects mainly in the way of public health that both sections would do well to consider.

It would be manifestly ridiculous to rush into any snap opinion as to the proper solution of the negro problem in the South. That is something that the South has been living with for a century and its complications are well known. It can be suggested, however, that this migration menace is only a part of the general problem and it will hardly be solved by the prohibitory legislation some of the states have been considering. The causes spring from economic and social conditions beyond the control of legislative enactment that does not curtail that liberty of movement from state to state that is the right of any and all American citizens. It is to these causes that the South should address its efforts, chiefly by individual and local civic attitude and action.

Consider first and chiefly the matter of health. Many of the negro workers that are coming North bring their families and most of the others will do so earlier or later. That means increase in negro population with its attendant social and health problems. It is a well known fact that, North and South, the general infant mortality rate and the death rate from some of the most dangerous communicable diseases are much higher among the colored than the white. Consequently material additions to the negro population of the North will increase the death rate from all these causes, and some of the mortality causes not merely by the addition of negro population but also by the spread of communicable diseases from negro to white.

By the same means, there will be mortality declines in the South. The actual Southern declines, however, will be affected somewhat by the economic reactions to the northward migration of the negro. Insofar as this migration causes industrial depression in the South and makes living conditions worse than before among the negro residue and the mass of the white population, the depletion of the negro stock will tend to increase mortality; but conceivably the lessened population will not have so hard a struggle for existence as did the original number. At the North, the negro who has migrated there will presumably be under better average conditions than he was in the South. He may find his higher wages largely absorbed by a higher living cost and in general his housing conditions will be far below the ideal, but on the whole he will probably have more, better and safer food, safer water to drink, more chances to bathe, a less polluted soil and far better administration of public health activities, state and local, than in the South.

Aside from its general sociological import, it should be

remembered that this negro migration is only one phase of the present larger matter of immigration restrictions. Both North and South should realize that the American-born colored population is a great national asset, the present value and the future possibilities of which are only beginning to be appreciated. When the negro was the great dividing issue between two sections of the country there was no possibility of a shortage of labor in this country. Foreign white men with potentialities in every field of labor were pouring into the country. There was greater difficulty in finding work for the men than men for the work. Today conditions are the exact opposite. Few potential workmen are coming into the country and the big labor problem is how best to utilize those man resources we already have. The racial and psychological difficulties of the negro problem remain and its historical significance is still great; but with all this it must be remembered that the negro today is an American, with none of the problems of Americanization thrust upon us by that class of foreign born which is so eager to enjoy and yet so ready to abuse American opportunities.

Farm-Bloc Water-Power Economics

GRAY SILVER, the efficient Washington director of the American Farm Bureau Federation—which is the boss of the farm bloc in Congress—has just rendered a report on his year's work. It is a good report, even tempered in the main, mildly and justly prideful of the accomplishments in the way of legislation and worthy of the respect of all who want to see the farmer prosper and get the due which of late years has been largely denied him. So long as Mr. Silver sticks strictly to farming, he follows a straight path; but for a time he wanders in the strange domain of water power and there, under the hypnotic eye of Henry Ford, his steps falter. Interest on investment, according to Mr. Silver, is the curse of water power development. Ford's Muscle Shoals plan leads the way to escape, he says, because by it not only is the interest charge cut in half by the use of government instead of private credit, but by the magic of amortization the whole fixed charge vanishes in time and the user need pay then only for operation. This, says Mr. Silver, is a devoutly to be wished consummation which the farmer must fight for.

Those who see in Mr. Ford just the manufacturer of a good little car wonder why we should confine this idealistic scheme to water power, more particularly to one man's use of one water power. Why not extend it to every line of enterprise? Let any prospective manufacturer, or farmer, or merchant get the government to supply the capital for his plant, or farm, or store, to be paid back in 100 years by his paying 4 per cent interest plus one-tenth of 1 per cent of the capital per year, which latter minute percentage the government each year will invest and continue to re-invest until at the end of 100 years the whole loan has, by magic almost, been repaid.

Except that Mr. Ford, in addition, wants to get for $5,000,000 what cost the government $90,000,000, the analogy between his offer and the hypothetical case is complete. Muscle Shoals, under the Ford offer, would not be a public benefit, except insofar as the public is able to buy more cheaply the products that Mr. Ford may make at Muscle Shoals, and in the event, which he does not promise or contract, that he would be able to manufacture there fertilizer at a lower cost than it is now purchasable. No farmer, or manufacturer, or city dweller under the Ford plan is going to be able to buy power for his own use from Muscle Shoals. It is purely a cheap manufacturing proposition for Mr. Ford plus the possibility—but only the possibility—of a cheap fertilizer.

Mr. Silver's advocacy of this particular scheme is explainable only on the ground that most people believe in a kind of Socialism which extends government aid where it will benefit them and them alone. Or else it is a Utopian conception of this country as another place where people will make a living by taking in each other's washing. Under this scheme the citizens of the United States will divide into two classes, one lending the government money at 4 per cent, the other borrowing the same money back from Uncle Sam at the same rate.

Questions As To Seasonal Building

THE committee organized by the Department of Commerce to investigate seasonal building announced that first it intends to asecrtain facts. In so doing it measurably increases confidence in its usefulness. It is presumable that the periods of active and slack building vary both in duration and in the time of year when they occur. Beyond this little is known of their character. There may be and very probably are different busy and idle seasons in Boston and in New Orleans and they may be shorter or longer in one place than in the other. It seems reasonable that the causes also may be different. Certainly cold weather is less a reason for idleness in New Orleans than in Boston. Are there other weather conditions prevailing in the southern city which offset the frosts of the New England metropolis? It deserves to be repeated that we do not know. Facts are needed. The committee cannot be too insistent on this point.

A great deal of our belief in the prevalence and intensity of seasonal building is based on rather nebulous general opinion. In the few instances in which actual determination has been made it has been found that the peaks and valleys of building activity are not so high and deep as they were; that they show less seasonal regularity than they formerly did, and that the causes are apparently more complex than they were once assumed to be. All the evidence indicates that the committee must be more insistent in exacting real facts and not be contented with eliciting general opinion by a few inquiries directed to building department heads.

It is indeed a rather difficult and complex inquiry which the Hoover committee has undertaken and nothing but serious effort will disclose the information which will command the respect of those who borrow and lend money for building. These are the persons who have to be influenced and not contractors and engineers who are merely the agencies for performing the physical tasks.

To what extent does seasonal building construction prevail? What is the character of the variation? What are the causes? With actual facts to answer these questions the building industry is in some sort of position to devise and apply remedies. It is encouraging, as has been said, that the Department of Commerce committee is disposed to seek facts first. Those to whom it will appeal for information should respond with all the labor required to furnish these facts.

Highway Progress and Problems in the Mid-South—II

South Carolina North Carolina
Virginia West Virginia
Kentucky Tennessee
Missouri

Seven Southern States Contemplate Road Expenditures Approaching a Billion Dollars—Automobile License Fees and Gasoline Taxes Will Provide the Money—Editorial Review Based on Studies in the Field

This is the second article of the series. The first article of the series, on Group Problems and the two Carolinas, appeared in "Engineering News-Record" July 26, 1923, p. 128.

The Two Virginias

HIGHWAY development exhibits quite different aspects in Virginia and in West Virginia. The last named has been one of the most prompt of the Southern states adequately to finance and plan a comprehensive state highway system. It has centralized the administration of highways very completely in a state highway commission. A conservative but active construction program has been commenced with attention to the development of trans-state through routes and interstate connections. Virginia on the contrary has been dilatory

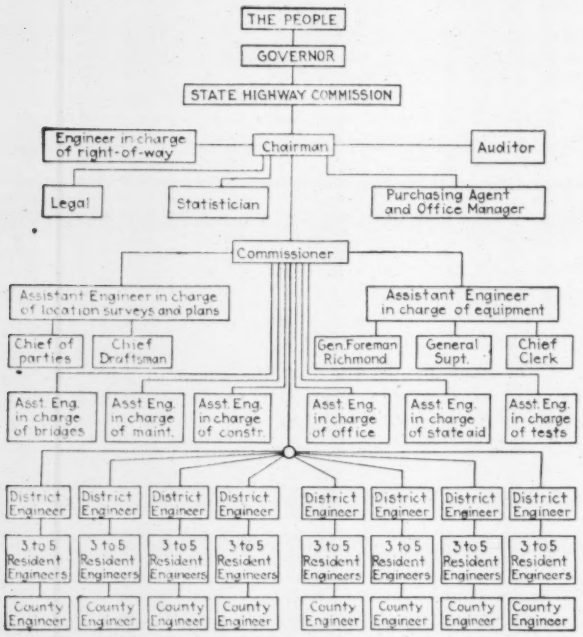


FIG. 3—VIRGINIA HIGHWAY COMMISSION ORGANIZATION CHART

in taking action to finance road improvement and is undecided whether to issue bonds or to build with current funds. Correlated and connected system development and particularly through-route development, are delayed by laws putting the selection of state-road routes and their extension in the hands of the Legislature and specifying simultaneous district and county allotment of improvement funds and operations.

There is a fundamental difference of highway thought in the situations as outlined. West Virginia is thinking primarily toward system development without overlooking local development. In Virginia the thought is primarily toward evenly distributed local improvement out of which, incidentally, system development will slowly come. It will be understood that highway thought, as the term is here used, is thought as manifested by all the acts of the state in highway affairs and not necessarily the thought of the state highway commission or even of the state administration of the moment.

Virginia

Debating Methods of Financing

Highway development in Virginia awaits the decision of a bitter contest over methods of financing road improvement. On one side are the advocates of a pay-as-you-go policy, requiring a construction period of seven to ten years, led by Governor Trinkle. Opposed are the advocates of a $50,000,000 bond issue and a five-year construction period led by the Virginia Good Roads Association, George P. Coleman, president.

From the press and speakers platform last fall, the debate was carried into the Legislature of 1922-23. Securing no action at the regular session, a special session was called. It met the situation by imposing the 3c. gasoline tax asked by the pay-as-you-go party and by authorizing a referendum vote of the people (November, 1923) on a bond issue as proposed by the advocates of that plan. Now again the battle is being waged in the public press and forum.

Virginia has an area of 43,627 square miles and a population less than 2,500,000. The state system consists of 4,200 miles of road designated as to general routes by legislative acts. Of this system some 1,500 to 1,800 miles—the estimates vary—are classified as reconstructed. Not all of this mileage is permanently graded and only a minor part is highly improved; all, however, has had some sort of surfacing which makes it passable to travel except in distinctly bad periods of weather. In general the system is unimproved in the modern sense of the term improved as applied to roads in the older road-building states of the north. Virginia roads are unqualifiedly "in the mud." This is not said captiously but to make it entirely clear what it means to produce a state system of modern improved roads.

It is a task involving organization, legislation and a comprehensive plan of financing, besides the physical problems of construction and maintenance. All of these processes except financing and construction are well advanced. Even maintenance, with commendable foresight, as will appear, has made progress. There is behind all a strong public sentiment for better highway transportation, as indicated by the advantage taken of the Robertson act privately to finance road construction.

By this act, passed in 1920, any county, district, cor-

poration or person desiring improvement of any section of state road is enabled to finance the work on the basis that the State Highway Commission plans and directs it, that the money is loaned to the state without interest and that the state shall repay the loan in some indefinite period as funds are available. In the aggregate some $6,000,000 in funds of this character have been voluntarily loaned to the state to ensure specific new roads which the Commission had no money to build but which the people wanted badly enough to provide the money without interest return for an indefinite period.

This body, recreated by the law of March 24, 1922, which scrapped a mass of confusing legislation, is organized on the basis of the chart, Fig. 3. As stated, little construction has been accomplished. There have been no adequate funds for new work. Maintenance is somewhat adequately provided for by the income of about $2,500,000 from motor-vehicle license fees. At present the 4,200-mile state system is being maintained and this year patrol maintenance will be so perfected that no road will remain undragged 48 hours after rain or snow. In rapidly developing complete-system maintenance the public is being reached everywhere with highway service and with evidence of the efficacy of centralized state direction.

It is recognized, however, that there can be little fundamental improvement of road service by maintenance alone. Extensive new construction is necessary, and for this large funds must be had. With the 3c. gasoline tax law of March 26, 1923, it is considered by the advocates of pay-as-you-go construction that they are assured. Including all sources of income it is computed that, spread over seven years, nearly $64,000,000 will be available at the rate of seven to ten millions a year for new construction. The estimated income is from three sources mainly, as indicated by the statement for 1923:

Three cents per gallon motor fuel tax	$2,835,000
Federal Government allotment	1,457,000
State mill tax	1,735,000
State convict road force	350,000
Appropriation out of general fund:	
For construction	200,000
For overhead expenses	285,000
Amount which can be transferred from automobile license tax, after leaving $2,500,000 out of the $3,000,000 fund from this source for maintenance	500,000
Total	$7,362,000

For 1929 the total, assuming the natural increase in taxable values, is estimated as $10,077,000. In these estimates the only unfamiliar item is the credit of $350,000 for the state convict road force. Virginia's laws provide that convicts shall be employed on road construction on requisition by certain authorities.

The 3c. gasoline tax law was approved March 26, 1923, at the special session of the legislature. At the same session an act calling a bond issue referendum was passed in recognition of the strong faction which considered quick construction with borrowed money a preferable policy to slower construction according to the road money available each year. Between the two plans there is certainty of road construction on an extensive scale compared with anything before known in Virginia. It is the question now whether the people will decide on quantity production with a corresponding saving in construction cost and overhead and earlier returns in highway service or on delayed production with no debt at the end of the production period.

Physically the road construction task is rugged mountain work in the west—the creation of permanent grade from mountain trails. In the Piedmont section, with its higher industrial development, paved and surfaced roads have to be built in rolling, hilly, plateau country. The coastal plain offers a level bottom and swamp-land problem. Broadly the development problem is to open up permanently graded and drained main routes in as large mileages as are practicable. Traffic, except on isolated routes, is light and largely local, and permanent

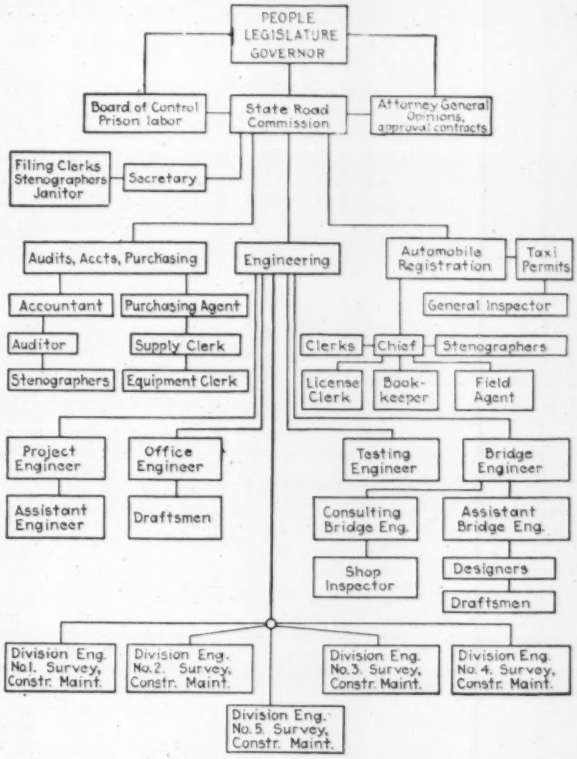


FIG. 4—WEST VIRGINIA HIGHWAY COMMISSION ORGANIZATION CHART

grades lightly surfaced and well maintained are the immediate requirements. With funds provided, the greatest drawbacks to logical system development are the laws requiring simultaneous allocation of funds to construction districts and counties. This makes continuous route development a slow process.

Money will be available for constructing the state road system as now planned. This is the significant conclusion of the situation as it exists. With the sources of income now provided the system can be constructed on a pay-as-you-go plan in perhaps seven years and certainly in less than ten years. If bonds are issued in the proposed amount of $50,000,000 the construction period will be reduced to perhaps five years. The $3,000,000 from motor-vehicle license fees turned over primarily to maintenance also assures that the roads can be kept up reasonably well as fast as they are constructed. In two years Virginia has recorded a distinct advance in her highway affairs.

West Virginia

Pushing System Construction

An advanced stage of construction has been reached on its state highway system by West Virginia. With a bond issue of $50,000,000 provided about the same

time, the state has been more conservative than North Carolina or Missouri in putting mileage under contract but within a year or two it can be crossed on continuous improved roads reaching from state line to state line. These roads are notable for their heavy grading at least half of which is rock. Grading costs run from $9,000 to $45,000 a mile.

Centralized direction is provided to an unusual degree in the general road law—the state road commission has complete control of location, construction and maintenance of state roads. There are about 1,700 miles in the 7 per cent system, and a little over 3,500 miles in the total state system. Fig. 4 shows the commission organization. The problem before the commission now is one of system construction, with proper consideration of the local interests of the whole state whose rugged, mountainous topography makes work expensive.

Road location is rather definitely defined by topographic conditions. The state is traversed by streams and along the river valleys and through the mountain passes the early settlers laid out their trails which later became public roads. Location is largely a task of straightening out the unnecessary kinks in these routes and of cutting down grades. In general it is practicable to keep grades below 7 per cent but maximum grades of 9 per cent are employed.

Grading is the large construction task. Taking the records as of Jan. 1 this year, which are the latest mileage figures for which all co-ordinate data have been summarized, there are 531 miles for which contracts have been let. Of this total 284 miles are to be graded and drained only, 228 miles are to be graded, drained and surfaced (all but 84 miles hard surfaced) and 19 miles are to be surfaced only. The 510 miles to be graded and drained call for 6,045,353 cu.yd. of excavation or very nearly 12,000 cu.yd. a mile. The average cost of grading and drainage, on the 284 miles on which these were the complete operation, was $14,282 a mile.

Excavation is not classified. However, not far from one-half is rock work. Grading is, generally speaking, a steam-shovel operation. The average contract price for unclassified excavation for the yardage given above was 66c. a cubic yard.

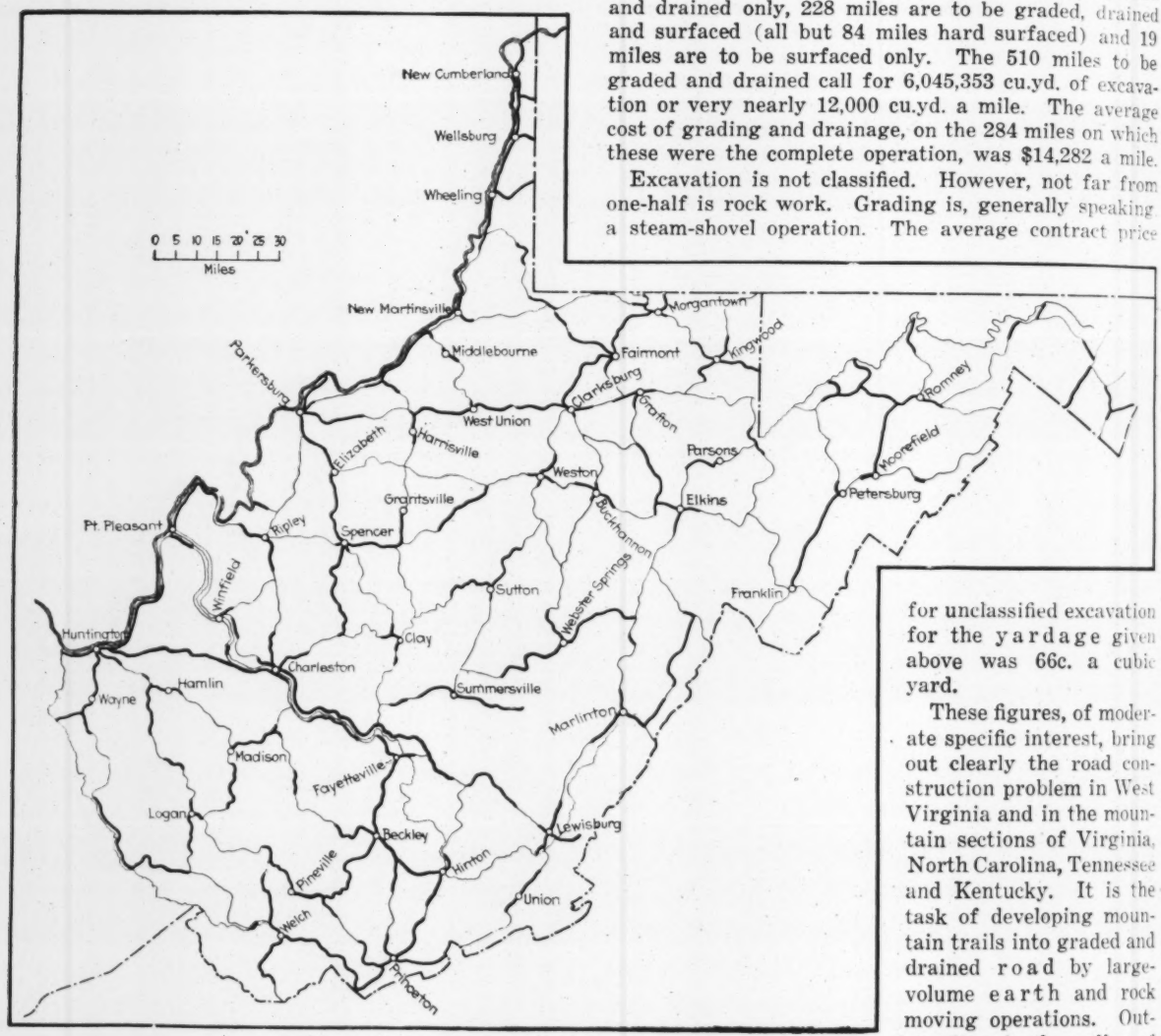


FIG. 5—WEST VIRGINIA ROAD MAP SHOWING PROGRESS OF SYSTEM DEVELOPMENT

These figures, of moderate specific interest, bring out clearly the road construction problem in West Virginia and in the mountain sections of Virginia, North Carolina, Tennessee and Kentucky. It is the task of developing mountain trails into graded and drained road by large-volume earth and rock moving operations. Outstanding is the policy of system development. Fig. 5 is a diagram map of the state road system. The light lines show unimproved road; the full lines show road completed or under contract for improvement to a condition of permanent grade or better. A glance indicates the advanced stage of formation of continuous through routes.

[*In the next issue the highway situation in Kentucky and Tennessee will be discussed.*]

Motor Vehicle Output Increases by Half in 1923

According to reports made to the Board of Directors of the National Automobile Chamber of Commerce at a recent meeting in Buffalo, the first half of 1923 has shown an increase of 47 per cent over the same period of 1922 when the output was 1,161,000 motor cars.

Concrete Caisson to Close Canal Against Floating Oil

In Manchester Ship Canal Floating Barrier Is Provided as Precautionary Measure in Case of Fire

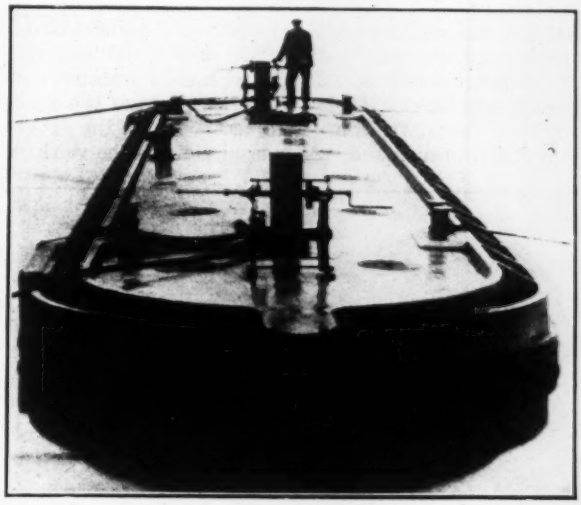
BY R. FRANKLIN MUNDORFF
Kansas City, Mo.

VERY large quantities of petroleum and oils of a flash point not lower than 73 deg. F. have been imported into England via the Manchester Ship Canal, during the last few years. Heretofore, however, the canal company has not permitted the importation of oils and spirits having a flash point below 73 deg. owing to the want of a safe place in which to moor the vessels while discharging their liquid cargoes. This difficulty has now been overcome by the provision of a separate dock and discharging equipment in an isolated situation in which the vessel can be shut off from the canal by means of a floating reinforced-concrete caisson, a precautionary measure in case of fire or escape of the spirit.

The dock is on the estuary side of the canal, while the oil companies' premises and land for future developments are on the opposite side, with road and rail facilities adjoining. The principal dimensions of the dock are as follows: length, 600 ft.; width, 100 ft.; depth of water, 30 ft.; and width of entrance 80 ft. The dock is placed at a convenient angle with the canal to give easy access for the ships, and the approach is provided with two reinforced-concrete dolphins on one side, a recess being provided for the caisson when this is not in use. In each of the main concrete piers at the entrance a vertical groove of a modified V-shape, faced with granite, is provided, and into these recesses suitably shaped projections on each end of the caisson fit, one end being secured by a wedge which is raised and lowered by a winch on the quay.

The foundation of the caisson is to act as a fire-stop at the dock entrance by preventing the escape into the canal of blazing oil in the event of a fire occurring within the dock. The caisson is a box-shaped vessel, nearly rectangular in section, with semi-circular ends terminating in substantial stem and stern posts. The length over all is 82 ft. 6 in., the beam is 12 ft., and the depth from crown of deck to keel is 10 ft. 3 in. The deck has a chamber of 4 in. and the bottom is formed with a fall of 6 in. from the bilges to the keel. A fore-and-aft central wall, together with six transverse bulkheads, divide the caisson into fourteen compartments, separate and watertight. At water level the hull is provided with timber fenders bolted to a reinforced-concrete counter carried by wings springing out from the upper parts of the sides. The total weight of the caisson without ballast is about 125 tons, and its draft is about 5 ft. 6 in. As the working draft is 8 ft. a certain amount of ballast, consisting partly of mass concrete and partly water, is placed in the various watertight chambers to give the requisite flotation.

Each of the compartments is provided with an air-tight manhole frame and cover on deck for purposes of access, also a scuttle plug and sounding pipe. The deck equipment comprises two deck winches one near each end, and four cast-iron mooring bits, two on each side of the vessel. For the purpose of adjusting the water ballast, and also for pumping out any or all of the ballast chambers, each compartment contains a 3-in. sluice valve connected to a 3-in. diaphragm hand pump fixed on deck. Each valve being operated by a spindle terminating in a watertight box, the various compartments can be dealt with singly or any number at a time as may be desired. The stem and stern posts, and also the portions of the "Samson" posts above deck level are sheathed with steel plates ⅜ in. thick. With the exception of the hull bottom, which is 4 in. in thickness, the concrete throughout the vessel comprising the sides, deck, bulkhead and center wall, is 3 in. thick,



CONCRETE FLOATING CAISSON TO ISOLATE FLOATING OIL

splayed out at the various intersections. The sides and also the center fore-and-aft wall are stiffened by vertical ribs spaced about 3 ft. 6 in. apart.

The reinforcement throughout the whole of the caisson consists of round mild steel bars of ordinary commercial section. No fabric or steel bars of special form were employed. In the case of the walls, bulkheads and bottoms upon which the pressure might fall from within or without, according to the manner in which the chambers might be charged with water ballast, the reinforcement had to be provided near to both surfaces. The deck, however, only required reinforcing in the usual way for downward pressures. The reinforcement in the floors, walls, bulkheads and deck consists of ⅜-in. and ⅝-in. diameter main and transverse bars suitably spaced and wired together at intersections. Heavier reinforcement, consisting of 1-in. and 1¼-in. diameter bars, is introduced in the vertical stiffening ribs, "Samson" posts, stem and stern posts; and also in keel, bilges, gunwales and along the top of the center wall. Whenever necessary, as, for example, in the stiffening ribs, steel stirrups are inserted in order to take up the shearing stress.

The whole of the concrete throughout the caisson is composed of portland cement, sand, and ¾-in. (Dalbeattie) crushed granite, mixed in the proportion of 224 lb. cement, 3¾ cu.ft. sand, to 7½ cu.ft. granite.

The concrete floating caissons were built by B. Morton & Sons, Manchester, for the Manchester Ship Canal Company of Manchester, England.

Reconstruction of Grandstand at Chicago Ball Park

Winter Work Necessitated Precast Concrete Slabs for Deck—Steel Frame—Old Building Shifted and Enlarged

IN THE improvement of the baseball grounds of the Chicago National League Ball Club (known as the Cubs' Park) for the 1923 season the principal features were: (1) cutting and moving a section of the steel and concrete L-shaped grandstand; (2) building new sections of the grandstand and extending its lower end by fourteen rows of seats; (3) building a deck of precast concrete slabs for the new work; (4) building two bleacher stands 36 x 235 ft. with steel framing and precast slab decks; (5) lowering the grade of the playing field about 7 ft. in order to accommodate the extension of the grandstand. A general view of the work is

FIG. 1—ENLARGING BASEBALL GRANDSTAND AT CHICAGO

shown in Fig. 1, with a layout plan in Fig. 2 and a typical section of the enlarged grandstand in Fig. 3. The additional seating capacity thus provided is 11,000 for the grandstand and 4,600 for the two bleachers, the total capacity being thus increased to 29,300 persons.

Grandstand Design—The original grandstand, erected in 1914 has a structural steel frame with reinforced concrete slab deck, the concrete being poured in place. Columns of steel H-beams spaced 18 ft. 9 in. c. to c. carry inclined 10-in. to 18-in. I-beams, the size of beam depending upon the span. Between the beams are stringers of 12-in. channels, to carry the individual slabs of the stepped floor. These old slabs have Hy-rib steel reinforcement with 2 to 3 in. of concrete above the steel and a ½-in. protective coat of cement mortar on the underside. This type of construction was adopted partly with a view to future enlargement and it is reported to have proved very satisfactory in moving, as the structure was very light but yet rigid enough to permit of easy handling.

Transverse steel cantilever trusses carrying the wood

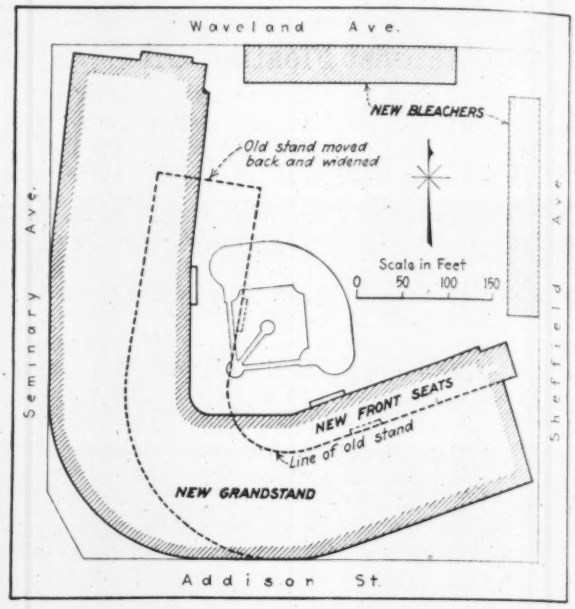


FIG. 2—PLAN OF CHICAGO NATIONAL LEAGUE BASEBALL PARK

roof construction are spaced 18 ft. 9 in. c. to c. and are 90 ft. long, 64 ft. between supports and with an overhang of 26 ft. The rear supports of these trusses are the extended columns of the grandstand. Each alternate truss has a column at the 64 ft. point, the intermediate trusses being supported by longitudinal trusses having a span of 37 ft 6 in. between columns.

In the new parts of the grandstand the steel design is practically identical with that of the older structure. For the 40-ft. extension along the lower side of both the old and new portions the framing consists of inclined 9-in. I-beams spaced 9 ft. 4½ in. apart, supported on concrete posts and carrying stringers of 6-in. channels. The upper portions of the grandstand are reached by means of ramps 10 ft. wide and having a grade of about 12 per cent. The lower portions of the stand are served by stairways 9 ft. wide and spaced an average of 80 ft. apart at two different levels. Those at the lower level are for the additional fourteen rows of seats and the upper ones are at the level of the main aisle, which separates the front or box seats from the grandstand seats. All steel was given two coats of paint after erection. Expansion joints are provided at intervals of about 100 ft. This whole structure, as well as the separate bleachers, was designed for a live-load of 100 lb. per square foot and in accordance with other requirements of the Chicago building ordinance.

Precast Slab Deck—In remodeling the grandstand, practically the entire work had to be done in freezing weather, since the date of the opening game of the season would not permit of any delay. It was decided, therefore, to make the deck of precast concrete slabs which could be handled and placed as required. This arrangement made it necessary to standardize the tie-rod and rivet spacing so that the slabs could be made with the necessary notches and recesses. Close cooperation of the designers of the steel frame and concrete slabs was required in order to secure the correct matching and fitting of the parts.

For the sake of appearance it was not desirable to place the ⅝-in stringer tie-rods below the slabs. Since

the slabs for the greater part of the work are in 2-ft. lengths the tie-rods were spaced 4 ft. c. to c., measuring from the center of each panel, the ends of alternate slabs being recessed accordingly, as shown in Fig. 4. The rivets securing the 2x2x⅜-in. angles on the top flanges of the stringers were spaced 12 in. c. to c. and the underside of the slab was made with recesses to fit over the rivet heads, except at the connections to the I-beams, where countersunk rivets were used. With the slabs in 2-ft. sections and laid in elastic cement no additional provision for expansion and contraction was considered necessary, and the expansion joints in the steel frame are not continued through the deck. Typical construction of the slab deck is shown in Fig. 4.

For covering an area of about 90,000 sq.ft. in the new work a total of nearly 16,000 slabs was required, and these were of 626 different shapes and dimensions, owing in part to the wedge-shaped spaces over the radial stringers and the different spacing of the stringers. These slabs are 2 in. thick for spans up to 3 ft., and 2½ in. up to 4½-ft. span all reinforced with No. 12 to No. 9 galvanized wire netting. The majority of the slabs were 2 in. thick and 24 in. wide, weighing 25 lb. per square foot or approximately 150 lb. each.

Each slab has its rear end resting on the lower flange of a stringer, or on a shelf angle riveted to the web in cases where the stringers are laid with flanges turned inward. The outer end rests on an angle riveted to the top flange of the next stringer, the upstanding leg of the angle protecting the face of the slab for its entire depth. To give the necessary slope for drainage a lug or heel is formed under the rear end of the slab. Elastic oil cement was used as a joint filler and was also placed on the angles as a seat for the slabs, the slabs being so placed as to form a squeeze joint. In this way the deck is made practically waterproof, which is particularly desirable in view of the fact that the deck is washed down with streams of water from a hose after every game. Folding seats of theater type are used on the grandstand, the iron legs being secured to the slab deck.

Casting the Slabs—Forms for the slabs were composed of steel frames having two 4x4-in. angles 11 ft. long, connected at each end by a flat bar secured to the horizontal legs by loose rivets so that the angles could be moved together or apart like the bars of a parallel ruler. Bottom boards were placed on the angles, with partition boards or dividers set on edge between them

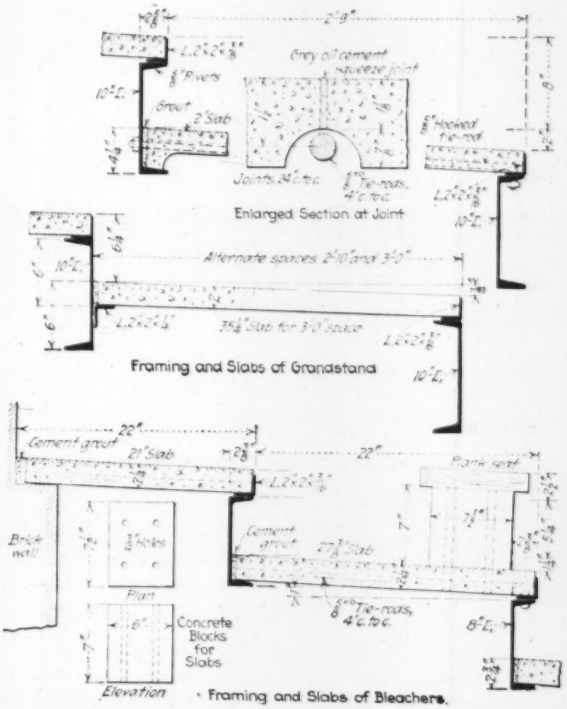


FIG. 4—DETAILS OF DECK CONSTRUCTION

at the required spacing and level with the tops of the angles. The boards were then wedged tightly in place by shifting one of the angles lengthwise. Sheets of the steel reinforcement were then set in place and held at the required height by small concrete blocks. Wet concrete of 1:3 mix, made with gravel of ½-in. maximum size, was poured into the forms, sprinkled with dry cement and then struck off with an iron bar, giving an even but slightly rough or granular finish.

To form the lug or heel under the higher end of the slab, the bottom board was cut away to the depth required. Special forms were needed for the numerous wedge-shaped slabs of various dimensions. Every slab was numbered to conform to its position as marked on the plans. The slabs were shipped to the park in railway box cars and distributed on warehouse hand trucks. Fig. 6 shows the handling and placing of the slabs. Manufacture was begun Jan. 15 and completed March 3; placing of the slabs was begun Feb. 27 and completed March 28.

Bleachers—For the steel framing of the bleachers, inclined 12-in. I-beams spaced 15 ft. c. to c. are supported by a front footing, a rear wall and two H-beam columns; upon these beams are stringers of 8-in. channels spaced 26 in. c. to c. and carrying the precast concrete slabs. The 4-in. concrete walk at the foot was poured in place, the concrete encasing the lower part of the first stringer. This construction is shown in Fig. 5. For the seats in the bleachers, Fig. 4, single planks

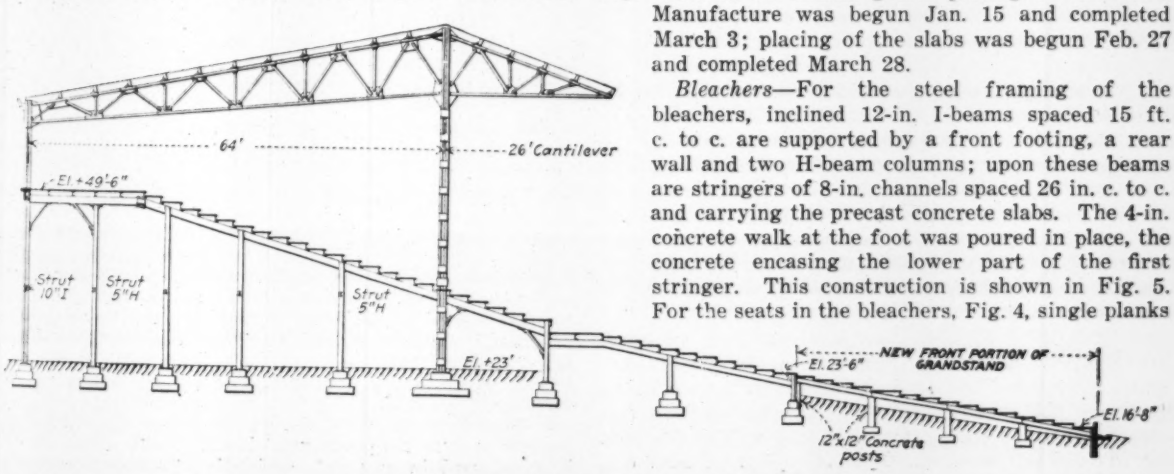


FIG. 3—TYPICAL CROSS-SECTION OF GRANDSTAND

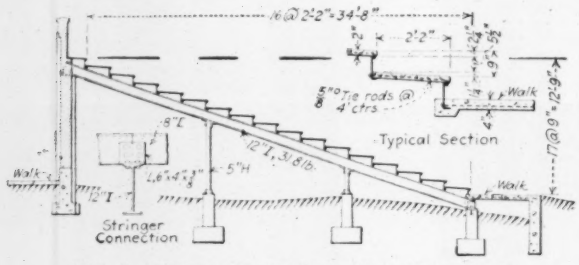


FIG. 5—STEEL AND CONCRETE BLEACHERS

2x10-in. are supported on rectangular concrete blocks spaced about 4 ft. c. to c. Each block has four ¾-in. cored holes, as shown, two for ½-in. anchor bolts holding the block to the slab and two for bolts to fasten the seat boards.

Moving the Grandstand—Preparatory to moving the two main sections to their new location, the stands were cut crosswise at the proper section and lengthwise just in front of the main aisle. This gave the moving contractors four sections to handle, the largest rectangular section being 80 x 244 ft. All cutting of steel was done with acetylene burners and the light concrete slabs were cut with chisels. The rear northwest section

FIG. 6—PLACING PRECAST DECK SLABS

was moved first, being moved north as far as required, 120 ft., and then west to its new location. By the time the stand section reached this position the lower courses of the footings had been placed. The upper courses with anchor rods and masonry plates were poured after the stand section was in place and before the blocking was removed. The same procedure was followed in the other portions of the stand. After the moving was concluded, an examination of the structure failed to show any cracking of the slabs, or any defects due to moving. For this work each section of the structure was raised by jacks and rolled along tracks of steel rails laid on top of blocking, being moved by means of cables and horse capstans.

Grading the field to its new level was done by a revolving steam shovel. Drainage of the field at its new grade is provided for by a main tile drain starting at the home plate, extending under the second base and across the outfield and emptying into a 9-in. drain at the far end of the field. Lateral drains of 4-in. tile, spaced 12-ft. apart are placed beneath the diamond and infield, and 4-in. laterals, 25 ft. apart are placed in the outfield.

Speed of Construction—Actual moving of the first section commenced Jan. 10; on Jan. 11 it was in its northern position, a distance of 120 ft.; movement 120 ft. west was started Jan. 14 and concluded Jan. 16. The record time was made on Feb. 8 when the main curved center section, about 80 x 275 ft. in plan, was moved to its new location, a distance of about 90 ft., in two hours. As soon as the first or northwest section was in place, erection of the new steel framework was started, and the old center section was in its new position by the time the erectors were ready to connect to it. Directly after the steel erectors came the cement slab erection crews, which dropped the slabs into place as they moved southward along the stand. The first slab was laid Feb. 27 and by March 15 the grandstand was practically completed. On March 29 the slabs for bleachers as well as for the grandstand were in place, the placing of 14,600 additional seats having been done in 30 days.

Engineers and Contractors—The architect for this work was Zachary T. Davis, with the Westcott Engineering Co. as consulting engineers and designers of the steel framing and concrete work. Lanquist & Illsley were the general contractors; L. P. Friestedt & Co. did the moving of the old structure and erected the steelwork; the Vanderkloot Steel Works fabricated the steel and the Federal Cement Tile Co. made and placed the concrete slabs. All these are Chicago firms.

Some Fallacies on Power Development

Abstract of a paper read before the Southern Appalachian Water Power Conference by O. C. Merrill, executive secretary, Federal Power Commission.

THE popular fallacy that since water costs nothing and runs downhill it can be used to develop power cheaply under any conditions has resulted in proposals to build many water-power plants and in the construction of some that are not economically justifiable. The estimates for many of such developments stop at the generator switchboard, and overlook or ignore the cost of transmission and distribution, and of auxiliary steam reserve. Many also fail to consider the accessories to the actual construction of the dam and power house such as camps, roads, railways, construction equipment, and overhead organization.

Another popular fallacy is that any state can permanently gain at another state's expense through monopoly of its power resources by placing embargoes on the export of electric energy. Such a fallacy overlooks the fundamental fact that we are first a union of states and that our prosperity must be mutual or it does not exist. The federal government as an agent of all the people does not acquiesce in this policy. It has full control over public lands, interstate trade, transportation as an agency of such trade, and over river improvements as needs of transportation. It can construct such improvements at its own expense but prefers to delegate such construction through the agency of the Federal Water Power Act wherever such developments affect public property, which condition applies to most major water-power resources of the country.

Efforts to prevent the development of water-power sites under the Federal Water Power Act on the score of public interest are ill advised. Rates, service, and the issuance of securities and the disposition of excess profits are under federal control and the people are consequently well protected. Moreover the development of water power on many streams by private capital will produce important navigation improvements which would otherwise require large expenditures by the government itself. These items should be considered in any state legislation tending to restrict development under the Federal Water Power Act.

International Navigation Congress Held at London

Meeting Postponed by War Well Attended—Papers Excellent but Discussion Limited—Conclusions Unanimous

By Frank T. Chambers
Captain, C. E. C., U. S. Navy, Washington, D. C.

Special Correspondence

UNDER usual conditions International Congresses of Navigation are held at intervals of three years. The last congress was in Philadelphia in the spring of 1912, so the world war has caused a delay of eight years and an interval between the twelfth and thirteenth congresses of eleven years. This fact and the title of the congress, which would lead the casual reader to the hasty conclusion that the subject matter is only of indirect interest to engineers, justify a brief foreword.

The congresses are in fact of particular interest to all engineers engaged in waterfront construction and river and harbor improvement. They are held under the auspices of the Permanent International Association of Navigation Congresses, which has its headquarters at Brussels, Belgium, and which is supported by contributions from some 36 countries or dependencies, more than 200 corporations or institutions and over 1,500 individual members. The United States, through congressional act of June 28, 1902, became a maximum contributor with an annual appropriation of $3,000. It thus results naturally that the United States delegates this year to London were selected largely from those departments of the government which are most directly concerned in port development, aids to navigation, etc. Those commissioned by the State Department were Col. J. C. Oakes, Corps of Engineers, U. S. A., vice-chairman, Inland Navigation Section; Capt. Frank T. Chambers, C. E. C., U. S. N., vice-chairman Ocean Navigation Section; Capt. C. L. Hussey, U. S. N., naval attaché, American Embassy; Maj. O. N. Solbert, Corps of Engineers, U. S. A., military attaché, American Embassy; Rear Admiral William E. Reynolds, Commandant U. S. Coast Guard; George R. Putnam, U. S. Commissioner of Lighthouses; Col. E. Lester Jones, director, U. S. Coast and Geodetic Survey; John C. Hoyt, hydraulic engineer, U. S. Geological Survey; Walter Tower, commercial attaché, American Embassy; Capt. W. F. Purdy, operating manager, U. S. Shipping Board at London; Huntington T. Morse, European manager, U. S. Shipping Board, Emergency Fleet Corporation, and W. W. Atterbury, vice-president, Pennsylvania Railroad. Messrs. Jones, Hoyt and Atterbury did not attend.

The program was divided into two sections: the first, Inland Navigation; the second, Ocean Navigation. Each section was subdivided into "Question" and "Communications," the first being given the place of honor, the second, such time as could be spared after disposing of the first. The topics were:

Inland Navigation

Questions—1. Utilization of waterways for the production of power; its consequences and applications.

2. Dispositions or arrangements to be adopted for locks, elevators, inclined planes, and other means of overcoming differences of level with a view to facilitating the operations.

Communications—1. The influence of surface waters and subterranean sheets of water on the flow of rivers. Regime of mixed canals; estimation of the water consumed for navigation and irrigation uses; the portion returned to the subterranean sheet of water.

2. Unification of statistics of inland navigation with a view to facilitating the comparison of the results of the working of navigable waterways in various countries.

Ocean Navigation

Questions—1. The accommodation to be provided for ships in connection with the construction of new works at ports in order to satisfy the future dimensions of ships.

2. Types of works for berthing ships of great draft in tidal seas.

3. The relative advantages of ship equipment and port equipment for loading and discharging ships. Mechanical equipment of ports. Mechanical handling of freight. Loading, discharging and carrying between ships and the various depositing points whether covered by sheds or not.

Communications—1. Concrete and reinforced concrete. Their applications to hydraulic works; means to insure their preservation and their watertightness.

2. Use of liquid fuel for navigation and its consequences.

3. Utilization of tides for the production of power for the working and lighting of ports and for maritime works (working of lock-gates, etc. . . .).

4. Principal advances made recently in lighting, beaconing and signaling of coasts. Standardization (unification) of the languages of maritime signals.

Contributions of papers from the United States were:

First Section—Question 1. Col. William Kelly, Corps of Engineers, U. S. A., chief engineer, Federal Power Commission.

Question 2. Col. Edward H. Schulz, Corps of Engineers, U. S. A.

Communication 1. Prof. Daniel W. Mead, University of Wisconsin.

Communication 2. Dr. Grover G. Huebner, University of Pennsylvania.

Second Section—Questions 1 and 2. Capt. F. T. Chambers, C. E. C., U. S. N., consulting engineer on port facilities, Board of Engineers for Rivers and Harbors, War Department.

Communication 2. Commander Urban T. Holmes, U. S. N. (Ret.), M. Am. Soc. Naval Engineers.

Communication 4. G. R. Putnam, commissioner of lighthouses, Department of Commerce.

Procedure—The meetings of the congress were held in the splendid building of the Institution of Civil Engineers of Great Britain, under the patronage of the King of England. The proceedings were opened with great ceremony, Lord Desborough, President of the Thames Conservancy, presiding and introducing the Duke of York who made the welcoming address. Replies were made by a chief delegate for each principal country or principality represented at the Congress. Col. Oakes responded for the United States. There were delegates from twenty-six subscribing states and four representatives from non-subscribing states, inclusive of Soviet Russia. The Suez Canal company delegated M. Quellennac, consulting engineer, and M. Felix, chief of the technical service. Official delegates were actually present from French West Africa, Belgium, Brazil, Chile, China, Czecho-Slovakia, Denmark, Finland, France, Great Britain, Greece, Holland, Hungary, India, Irish Free State, Italy, Japan, League of Nations, Monaco, Norway, Persia, Poland, Portugal, Rhine Commission, Rumania, Saar Territory, South Africa, Spain, Sweden, Switzerland, Tunisia, United States of America and Uruguay. There were twenty

British corporations represented, individual members bringing up the total attendance to about four hundred people.

After the opening ceremonies were concluded the registration book was opened, the first signature being that of the Duke of York. Immediately thereafter the sectional meetings were begun and continued throughout the week, the Inland Navigation Section considering and debating the general conclusions, prepared in advance by general reporters, on thirty-nine papers; the Ocean section, eighty-eight papers. The Ocean section attracted about twice the number attending upon the Inland section.

With so many papers it was impossible to read any and resort was had to the conclusions of the general reporters, who, under the rules of the International Association, made definite findings for discussion. The presiding officers, Lord Desborough for Inland Navigation and Sir Ernst Glover for Ocean Navigation, gave the members ample time for discussion, then appointed executive committees to recommend the final conclusions. Th. system worked well and although it is impossible to say that any new fact was disclosed in these conclusions, it is gratifying to know that whereas methods of construction and equipment, particularly of seaports, differ widely in different parts of the world, these delegates, many of them of international reputation, were practically unanimous in their opinions as to the general principles upon which engineering practice should be based.

Conclusions—The conclusions for Question 1 of the first section dealt upon the necessity for the development of all available water power, under a single control for each country, the development for power to be made in conjunction with and never neglectful of navigation, but bearing in mind also flood control, irrigation, drainage, domestic water supply and fisheries.

For Question 2, the dispositions for overcoming differences of level on canals, etc., it was decided that no precise indications were possible but certain general principles were laid down, scarcely worthy of repetition.

In treating of the first and second questions of Section 2 it was wisely decided that these questions were so intimately related as to require no separate discussion. It was concluded that while there is a general tendency for ships to increase in size due solely to cost of ship operation, without reference to increased cost of port facilities, the depths of the natural harbors and waterways of the world and the cost of providing harbor facilities for quick dispatch of the largest ships should tend to check increase of draft beyond thirty feet; that there will be an increase in the average tonnage of ships between 5,000 and 8,000 tons but not in the tonnage of the largest pre-war ships, in the near future; that while 40 ft. of water has been provided recently for Atlantic liners, the provision for cargo ships has been much more modest; that it will be difficult to justify more than 35 ft. of water at lowest tide for many years to come for other than Atlantic passenger liners, while a port providing 30 ft. of water would be considered first-class.

Concluding the third question the congress expressed a preference for port equipment such as cranes and conveyors rather than to depend upon ship equipment but declared it necessary that ships be equipped with winches, cargo masts and booms, both for use in ports unequipped with booms and hoists and for safety of the ship itself in cases of grounding or of shifting cargo at sea.

Under the rules no conclusions were drawn on the "communications."

Many of the papers submitted were excellent. Strangely, most of them dealt with only one or two features coming under the particular head, as for instance, types of quay walls under the subject of facilities to be provided for ships. Few took the subject as a whole and analyzed it. Among the papers dealing with one phase only may be mentioned that by Sir Robert Hadfield who, under "Concrete and Reinforced Concrete," took for his actual subject "The Corrosion of Ferrous Materials with Special Reference to Their Resistance to the Action of Sea Water," furnishing not only an interesting paper but a valuable bibliography of his subject. An interesting paper by L. H. Savile, civil engineer in chief, British Admiralty, gave detailed figures to prove his contention that the cost of harbor works increases as the cube of the draft provided. While this can scarcely be possible as a general rule, the paper is well worthy of attention. In fact, while many of the papers are of little value from the standpoint of American practice, there are many good ones and the engineer who possesses a set will prize it highly.

The congress was closed with much the same ceremony with which it opened. Representatives of several countries were called upon to speak. The writer spoke for the United States and was delighted to have the opportunity to thank the British Organizing Committee and the other organizations and agencies who made us all feel at home and otherwise contributed to our profit and pleasure. The way the two chairmen and their secretaries handled our unwieldly convention of representatives of so many nationalities is worthy of all praise.

The social side of the congress was indeed most enjoyable. We were lunched and dined and given receptions and the ladies were taken sightseeing. Particularly charming were the visits to Taplow Court, the beautiful home of Lord Desborough on the Thames, and to Windsor Castle, while the railways and dock authorities were most generous in providing instructive excursions to Southampton, Bristol and South Wales ports, as well as to the Victoria and Albert and King George docks at London.

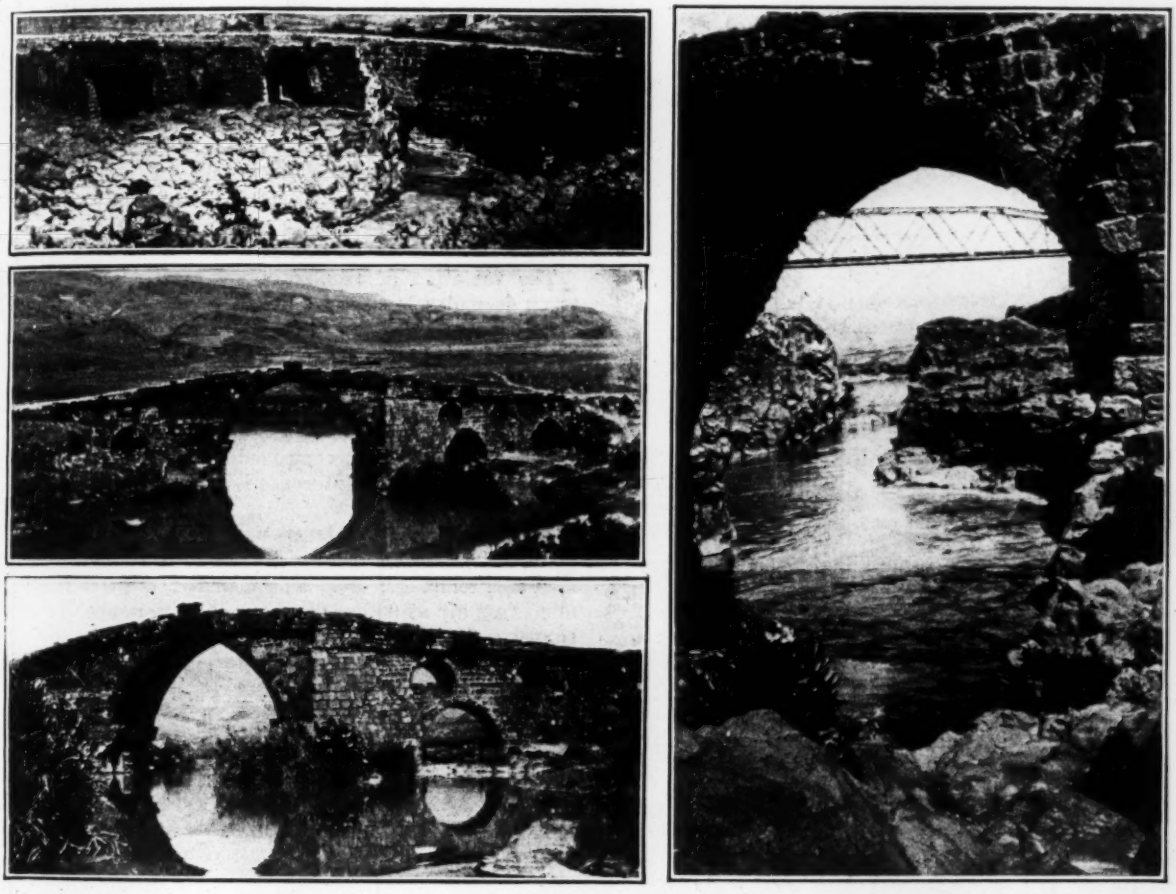
To Fill Bed of Abandoned Canals in Syracuse

Under a tentative plan agreed upon by the city administration of Syracuse, N. Y., for the disposition of the land pertaining to the abandoned portions of the Erie and Oswego Canals within the city, none of the land will be sold except that upon which there are permanent encroachments. As funds permit, an intercepting storm-water sewer will be built in that portion of the Erie Canal from Onondaga Creek to the easterly line of the city. As fast as the sewer is built the canal will be filled above the sewer to the grade of intersecting streets and the bridges will be removed. A portion of this intercepting sewer work will be carried out at once. The sewer will have a rectangular cross-section above a curved invert, the dimensions being about 10x12 ft. and the grade 2 ft. per thousand. The Oswego Canal will be filled as rapidly as funds are available. A portion of it will be used for an extension of the city market.

Bridges Antedating Christian Era Still in Service

TWO BRIDGES that rank among the very oldest in existence, certainly among the oldest that are still carrying traffic, were recently photographed by P. W. Etkes, assistant district engineer of the Northern District of the Public Works Department of Palestine, resident at Haifa. Both bridges lie on the old highway from Galilee to Jerusalem, and cross the Yarmuk and Jordan Rivers respectively. They were built many years before the Christian era, according to the best available information, but were repaired in later years by the Romans and the Saracens successively. Only a few weeks ago, Mr. Etkes says, he crossed these bridges "in a Buick seven-seater with eight people in it," obvious proof that they are still giving service. New bridges are planned, but the old ones will be preserved for their historical importance. The modern steel bridge near the Saghir bridge, which may be seen in one of the views, is the railway crossing of the Yarmuk in the direction of Damascus.

As may be judged from the pictures, both the foundation conditions and the climate are favorable to long life of masonry arches, and the long preservation of these structures may be in part credited to this fact.



PALESTINE BRIDGES OF GREAT ANTIQUITY, REPAIRED IN THEIR LATER YEARS BY THE ROMANS AND SARACENS

These structures are still in service. They are to be preserved by the Department of Antiquity of the State of Palestine. The upper view and the view at the right show the Saghir bridge over the Yarmuk River, the two lower views the "Jisr Mujamia" over the Jordan River. The former has a span of 24 ft., and the height from keystone to water level is 39 ft., while the water is about 28 ft. deep. The Mujamia bridge, which, by the way, has an angle in its alignment just beyond the right end of the main arch, has a main span of 41.3 ft. and a clearance height of 30 ft. The water under this span is about 33 ft. deep. The Saghir bridge (upper view) is reported to be 3,000 or more years old.

Port Officials Act on Equipment Design

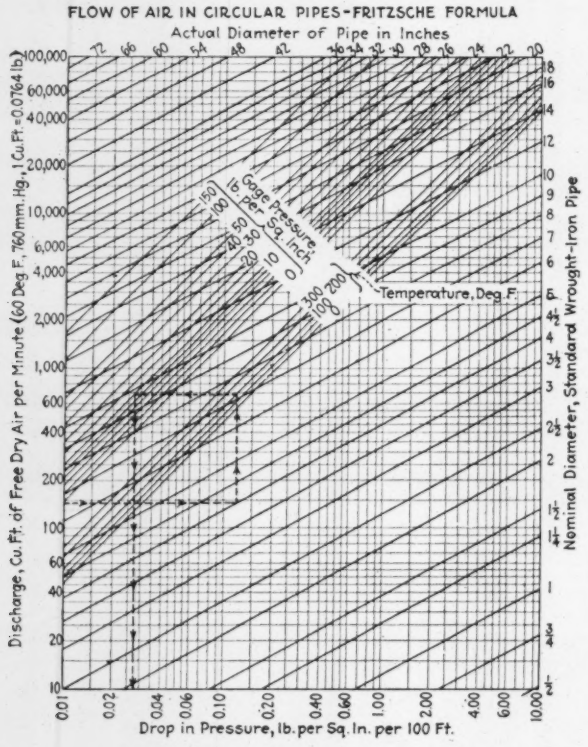
THE American Association of Port Authorities, at its meeting of June 12 at Montreal, adopted a resolution the substance of which was that in view of the international character of ocean transportation an effort should be made to bring about greater co-operation in the design of port equipment with the object of making it all as nearly uniform as is possible so that ships calling at strange ports would not encounter cargo-handling equipment unsuitable to their loading and discharging arrangement. A committee consisting of Captain F. T. Chambers, of Washington, D. C., Dr. Brysson Cunningham, of London, and A. D. Swan, of Montreal, was appointed to communicate the substance of this resolution to the principal port authorities throughout the world, and to report their findings to the association at its next meeting. At the time Capt. Chambers received this resolution he was attending the thirteenth international navigation congress at London and he took the opportunity to communicate it to the large number of representatives from the various ports of the world assembled at that congress. The association realizes the many difficulties to be overcome in carrying out such a plan of international co-operation but it expects to get a great deal of valuable information thereby.

Air-Pressure Losses in Piping of Activated-Sludge Plants

Comparative Study of Seven Formulas with Particular Reference to Pipe Layout of Large Plant for Chicago Sanitary District—Relation of Pressure to Pipe-Capacity

By H. L. McMillan
Assistant Engineer, Sanitary Division, Sanitary District of Chicago

IN PRELIMINARY studies of air mains and piping for a contemplated large activated-sludge plant for the Sanitary District of Chicago the formula of Fritzsche was used, results being easily determined for various lengths, sizes and flows from a chart of losses of pressure per hundred feet of pipe, prepared by Arthur B. Morrill (reproduced herewith). To compare the Fritzsche with six other recognized formulas the accompanying table of comparative pressure losses under certain assumed conditions was prepared. The other six formulas are: Wilson & McAdams, Unwin, Harris, D'Arcy, Rix-Johnson, Sturtevant. The last, adapted for ventilation work from the old Weisbach formula, was used in determining pipe sizes for the Milwaukee plant.


FLOW OF AIR IN CIRCULAR PIPES-FRITZSCHE FORMULA
Actual Diameter of Pipe in Inches
Discharge, Cu. Ft. of Free Dry Air per Minute (60 Deg. F., 760 mm. Hg., 1 Cu. Ft. = 0.0764 lb.)
Gage Pressure lb. per Sq. Inch
Temperature, Deg. F.
Nominal Diameter, Standard Wrought-Iron Pipe
Drop in Pressure, lb. per Sq. In. per 100 Ft.

FLOW OF AIR IN CIRCULAR PIPES BASED ON FRITZSCHE FORMULA

Of the seven formulas here considered, only the Wilson & McAdams formula deals with viscosity, through the friction factor f, as a function of z/dvs, when z = the viscosity.

Only the Fritzsche and the Wilson & McAdams formulas deal with the absolute temperature, the Fritzsche directly, as t deg. abs. F., and the Wilson & McAdams through velocity v, specific gravity s, viscosity z, and hence the friction factor f, all of which are affected by the temperature. The Sturtevant fan formula also deals with the temperature, if the velocity v is considered as affected by the temperature, which was not intended to be the case, evidently, by those who developed the formula for ventilating work. The pressure, or the unit weight of compressed air, is dealt with directly in all of the formulas but the Sturtevant, and that one may be considered to have compression factors, as velocity is affected by compression.

All of the formulas, except the Fritzsche, deal with the velocity or quantity of air flowing, raised to the second power, when rearranged in the form $p_1 - p_2 =$ func. $\frac{v^2}{d}$, or func. $\frac{Q^2}{d^5}$, while Fritzsche uses $Q^{1.852}$, similar to the results of Williams and Hazen in their hydraulic studies, in which they found $v^{1.85}$ as a controlling element, instead of v^2, and the results of many other investigators on air who found that the exponent varied between 1.75 and 1.95 for air, depending on the kind of pipe used and the quality of its interior surface. (See Mr. Eason's book, mentioned in footnote to table.)

The variation of results of computations by these seven formulas is chiefly due to the coefficient, fixed in some cases and varying in others. The Fritzsche coefficient is fixed, but as he found the pressure loss varied with the 1.852 power of the volume flowing, an average between 1.848 and 1.856, the fixed coefficient is admissible.

The exponent 1.852, compared with the exponent 2, makes a considerable difference in result, especially with large volume of flow.

When developed into terms used in the Fritzsche formula, in which Δp = drop in pressure, lb. per sq.in.; t = abs. temp. F.; L = length in ft.; Q = cu.ft. per min., free air at 60 deg. F.; p = abs. pressure, lb. per sq.in.; and d = diam. in in.; the comparison is:

Fritzsche,	$\Delta p = \frac{1.268\ t\ L\ Q^{1.852}}{1{,}000{,}000\ p\ d^{4.978}}$
Wilson & McAdams,	$\Delta p = \frac{1.046\ f\ t\ L\ Q^2}{10{,}000\ p\ d^5}$
Unwin,	$\Delta p = \frac{5.43\ f\ L\ Q^2}{100\ p\ d^5}$
Harris,	$\Delta p = \frac{4.2\ L\ Q^2}{10{,}000\ p\ d^{5.31}}$
D'Arcy,	$\Delta p = \frac{1.125\ L\ Q^2}{C^2\ p\ d^5}$
Rix-Johnson,	$\Delta p = \frac{2.5\ L\ Q^2}{10{,}000\ p\ d^5}$
Sturtevant,	$\Delta p = \frac{1.86\ t^2\ L\ Q^2}{100{,}000{,}000\ p^2\ d^5}$
Sturtevant, if temperature is not considered,	$\Delta p = \frac{5.05\ L\ Q^2}{1{,}000\ p^2\ d^5}$

It should be recognized that the Sturtevant fan formula was developed for ventilating work, etc., at or close to atmospheric pressure, and that the Unwin, Harris, D'Arcy, and Rix-Johnson formulas were developed for compressed air practice, seldom less than 60 or 70 lb. gage pressure, and therefore these five formulas are not strictly applicable to the problem of the moderate pressure of air for activated-sludge plants.

AIR-PRESSURE LOSSES IN ACTIVATED-SLUDGE PLANT PIPING COMPUTED BY VARIOUS FORMULAS

Slide-rule computations for various diameters, capacities, gage pressures, air temperatures and pipe lengths.

Diameter, in.	60	48	16	12	6	4	3
Capacity, cu.ft. per min. free air	90,000	60,000	5,060	2,250	525	150	120
Gage pressure, lb.	7	7	7	7	2.8	1.9	7
Temperature, deg. F.	150	150	100	100	113	104	60
Length, ft.	1,300	910	416	444	164	213	111
Fritzsche	0.100	0.100	0.100	0.100	0.100	0.100	0.100
Wilson & McAdams							
Cast-iron pipe	0.150	0.147	0.118	0.114	0.103	0.099	0.096
Copper pipe	0.111	0.110	0.088	0.087	0.083	0.084	0.081
Unwin	0.097	0.093	0.083	0.080	0.077	0.079	0.098
Harris	0.073	0.075	0.080	0.080	0.080	0.077	0.091
D'Arcy	0.127	0.128	0.127	0.122	0.105	0.094	0.108
Rix-Johnson	0.156	0.148	0.112	0.104	0.084	0.070	0.076
Sturtevant fan at 60 deg. F.	0.145	0.139	0.108	0.098	0.095	0.083	0.071
At temp. spec.	0.200	0.189	0.125	0.111	0.116	0.100	0.071

The pressure losses shown in the table are not for the exact lengths of the various sizes of pipe or conduit, as found in the plant proposed, but are for lengths of each size selected to give results by the Fritzsche formula equal to 0.1 lb. per square inch loss of pressure, so that easy comparison may be obtained. The sizes selected are suitable sizes for the plant, and the amounts of air flowing are approximately maximum amounts for each size of pipe in the plant.

The 60-in. size represents a main from the compressor room; the 48-in., a main header feeding many tanks; the 16-in. and 12-in. are branch headers in aeration tanks; the 3-in., the little branch pipes supplying air to the filtros-plate boxes. The 6- and the 4-in. are smaller branch headers supplying mixed liquor and sludge channels with air at lower pressure and lower temperature than that in the 48-in. header, such air being drawn from the 48-in. header at various points, and cooled by adiabatic expansion.

The high temperature selected for the large mains is due to probable adiabatic compression with centrifugal compressors, plus friction in compression. The temperature selected for the 16- and 12-in. mains is an approximate average due to cooling within submerged pipes, and that for the 3-in. pipes due to further cooling.

A gage pressure of 7 lb. per square inch is taken for simplicity, representing the pressure of 15 ft. depth of water, plus a small plate loss and pipe friction. Lower pressure in the 6- and 4-in. sizes is due to their supplying air to shallow troughs and conduits.

The Fritzsche Formula, $\Delta p = \frac{1.268\ t\ L\ Q^{1.889}}{1{,}000{,}000\ p\ d^{4.973}}$, is developed from Hütte (d. Ing. Tasch.), where it is given in metric equivalents. In the above form, Δp = drop in pressure, lb. per sq.in.; t = abs. temp. F.; L = length in ft.; p = abs. pressure, lb. per sq.in.; Q = C.F.M. free air at 60° F.; d = diam. in in.

Wilson & McAdams, $p = \frac{0.323\ f\ L\ s\ v^2}{d}$, in which p = pressure lost, lb. per sq.in.; f = a friction factor depending upon the value of the ratio $\frac{z}{dvs}$; L = length in ft.; s = spec. gr. referred to water at its greatest density; v = velocity, ft. per sec.; d = diam. in in.; z = viscosity, relative to water at 68° F. This formula is given in *Engineering News-Record*, Oct. 26, 1922, p. 690, in which article curves are given, showing values of f, depending upon $\frac{dvs}{z}$ and of z, depending upon temperature.

Unwin, $p_1 - p_2 = \frac{0.1005\ f\ M^2\ L}{D^5\ m} = \frac{32}{\pi g} \times \frac{f\ M^2\ L}{D^5\ m}$, in which p_1 and p_2 = initial and final abs. pressures, lb. per sq.ft.; f = friction factor, depending upon the diameter; M = weight of air in lb. flowing per sec.; L = length in ft.; D = diam. in ft.; m = average density of compressed air in lb. per cu.ft. This formula is given in "Flow and Measurement of Air and Gases," by Alec. B. Eason (J. B. Lippincott Co., 1919). Mr. Eason gives a table of values of the factor f for diameters from ½ to 36 in., and also gives the formula $f = 0.0027\left(1 + \frac{0.3}{D}\right)$, where D is in feet.

Harris, $f = C\ \frac{L\ V^2}{d^5\ r}$, in which f = loss of pressure in lb. per sq.in.; L = length in ft.; V = cu.ft. per sec. of free air; d = diam. in in.; r = ratio of compression in atmospheres; and C = coefficient containing all constants. This formula is given in "Compressed Air," by Elmo G. Harris, 1917, p. 50, as a fairly approximate formula, not as an exact one, however. Prof. Harris finds that the coefficient C depends upon the diameter, as $\frac{0.1025}{d^{0.31}}$, hence the equation can be written $f = \frac{0.1025\ L\ V^2}{r\ d^{5.31}}$. Harris gives values of the coefficient for sizes up to 12 in., which could be developed further, but the computations do not require it if the latter form of the formula is used.

D'Arcy, $D = C\sqrt{\frac{d^5(p_1 - p_2)}{w_1\ L}}$, or, $p_1 - p_2 = \frac{D^2\ w_1\ L_c}{C^2\ d^5}$, in which D = cu.ft. per min. of compressed air at final pressure p_2; C = a coefficient depending upon diam.; p_1 and p_2 = intial and final abs. pressures, lb. per sq.in.; L = length in ft.; d = diam. in in.; w_1 = density of air in lb. per cu.ft., at initial pressure p_1. This formula is given in "Air Compression and Transmission," by H. J. Thorkelson, 1913, p. 173, and values of the coefficient C are given for 1- to 12-in. pipe. By plotting values of $\frac{1}{C^2}$, as the coefficient is used, and smoothing up the curve a little, and extending it, values of C were obtained for the 16-, 48-, and 60-in. sizes, approximately, of course. The formula is also given in "Compressed Air Plant," by Robert Peele (John Wiley and Sons, 1913), p. 251, and in Kent, 1903 Ed., p. 489, as "a common formula for flow of air, gas, or steam in pipes," but is there given without any values of the coefficient C. Thorkelson makes no comment on the derivation of the formula. Peele specifies it as D'Arcy's formula.

Rix-Johnson, $p_1^2 - p_2^2 = \frac{0.0005\ V^2\ L}{d^5}$ in which p_1 and p_2 are initial and final abs. pressures, lb. per sq.in.; V = cu.ft. per min. free air; L = length in ft.; d = diam. in in. This formula is given in "Compressed Air Practice," by Frank Richards, 1913, p. 174, as Johnson's development of Church's formula, modified by Rix. Richards states that this formula gives results which are approximately correct in practice, and advises limiting the velocities of compressed air to 25 ft. per sec.

Sturtevant, $p = \frac{L\ v^2}{25{,}000\ d}$, in which p = pressure lost in oz. per sq.in.; L = length in ft.; v = velocity, ft. per sec.; d = diam. in in. This is the old Weisbach formula, revised, used by the B. F. Sturtevant Co. as a fan formula for ventilation work, etc.; it is given, as such, in Kent, 1903 Ed., p. 487, and in Prof. Thorkelson's book in a quotation from a lecture on ventilation by H. deB. Parsons. It was developed for ventilating work rather than for compressed air, and has no compression or temperature factors, except as introduced by the user in order to obtain the real velocities in the pipes.

The Fritzsche formula was developed from extensive tests in which the air velocity varied from 8.2 to 190 ft. per sec., temperature from 57 deg. F. to 239 deg. F., and pressure from 2.9 lb. per sq.in. absolute to 164 lb. per sq.in. absolute; but unfortunately the tests were made with small pipes only.

The Wilson & McAdams formula was developed for any fluid, from data on flow of air, steam, water, various oils, etc., under conditions where the diameter varied from capillary tubes to 36-in. pipes, velocity from 0.1 to 100 ft. per sec., density from 0.075 to 62.3 lb. per cu.ft., and viscosity from 0.02 to 3,000 times as viscous as water at 68 deg. F.

From the curves shown in the table for the values of f in Wilson & McAdams' article, it may be ascertained that for turbulent flow in cast-iron pipe the values of f conform closely to the formula $f = 0.0036 + 0.0063\sqrt{\frac{z}{dvs}}$, and from the curve for air viscosity the values of z change from 0.0207 at 150 deg. F., to 0.0158 at 60 deg. F., so that from the above equation the value of f would change but slightly with this viscosity difference, showing that, in the case of air, the element of viscosity has slight effect upon the loss of pressure, especially in the large pipe sizes.

Considering the question of varying the pipe diameters to get the same computed pressure loss by each of the seven formulas, in the case of the largest flow considered in the table below, the Fritzsche formula, for 0.100 lb. loss, requires 60-in. size; Wilson & McAdams would require 65-in. for cast-iron pipe, 61½-in. for copper pipe; Unwin, 59.6-in.; Harris, 56⅜-in.; D'Arcy, 63-in.; Rix-Johnson, 65.6-in.; and Sturtevant, 64.6-in. at 60 deg. F., and 69-in. computed at 150 deg. F.

In view of the great cost of pumping air for large activated-sludge plants, it is important to save all of the loss of pressure possible, to make a proper balance between economy of construction and economy of operation. It has been estimated that for each 0.1 lb. per sq.in. of pressure saved, at the proposed plant of the Sanitary District of Chicago, a saving of about $3,000 per year in cost of power will result, which would

warrant considerable increase of size of piping to decrease the pressure loss.

Investigators can do considerable service in checking up pressure losses in large piping, within the range of pressures used in activated-sludge practice, with the view of establishing the correctness of the formulas, or proper variations due to roughness of pipe surface.

Declares Pennsylvania Licensing Law Unconstitutional

Violates State Constitution in Treating Two Subjects and Federal Constitution in Being Discriminatory

IN THE Court of Quarter Sessions of Monroe County, Pennsylvania, Judge Samuel E. Schull on July 2 rendered an opinion that the Pennsylvania state engineering licensing act was unconstitutional. The case came before the court as the interpretation of a special verdict rendered by a jury in the complaint against George E. Stevenson, of the long-established engineering firm of Stevenson & Knight, of Scranton, Pa., who was arrested in June, 1922, charged with practising the profession of land surveying in Pennsylvania without having first obtained a license as required by the act of the Pennsylvania Assembly of May 25, 1921, Public Laws 1131. The procedure in the case was that the jury was instructed to render a special verdict which returned the decision to the judge on the question of the constitutionality of the act. The judge declared the act unconstitutional on three grounds.

He said it was in violation of Article 3, Section 3 of the Constitution of Pennsylvania, which provides "No bill, except general appropriation bills, shall be passed containing more than one subject, which shall be clearly expressed in the title." In this case the act bears the title "An act to Regulate the Practice of Professions of Engineering and Land Surveying, etc." The judge said that in view of the article of the constitution of Pennsylvania quoted, the question now was whether the professions of engineering and land surveying are distinct and independent or cognate branches of one subject. In considering this he quoted the section of the act which includes in its control "any person practising or appearing to practise the profession of engineering or land surveying." Thus, according to the judge, in the very beginning of the act the two professions are recognized as separate and distinct and throughout the entire text they are so recognized and treated, the professional engineer and the land surveyor being defined separately. The judge said that under the provisions of the act a registered engineer may not practise as a land surveyor nor may a land surveyor practise engineering, thus again marking or recognizing the distinctiveness of the two professions. Further than this, the judge called attention to the fact that the avowed purpose of the act is "to safeguard life, health, and property," and said "The relation of engineering to this purpose is, of course, apparent, but how it is related to the dissemination of area of land, the establishment of boundary lines of land and the subdivision or plotting thereof is beyond our conception."

The judge further notes that even in the profession of engineering the act makes certain exceptions, particularly as to officers and employees of the government of the United States and of the State of Pennsylvania and the officers and employees of a corporation engaged in interstate commerce. Thus, said the decision, "the qualification of the engineers who plan our railroad projects is left to the discretion of the office of the railroad company employing them, while, on the other hand, a land surveyor who runs a line and figures the area of a town plot on which the public has not the right of entrance must submit his qualifications to the board of engineers and be subject to their caprice as to whether or not he may engage in that character of business." In view of these contentions the judge decides that the act violates the state's constitution on account of dealing with two professions and the fourteenth amendment of the federal constitution in that it is discriminatory in the exemption of certain classes.

Further than that the judge contends that the section of the act which states that it shall be unlawful for the commonwealth, or for any county, city, borough, town, township, school district, or poor district to engage in the construction of any public works involving engineering unless the plans, specifications and estimates have been approved by and the construction supervised by a registered professional engineer, is in effect an act regulating public works and has no business in an act relating to the regulation of engineering.

In view of these facts he held that the act was unconstitutional and therefore prosecution under it cannot be sustained and on the special verdict of the jury he found the defendant not guilty.

Railway Improvements Cost 1½ Billions

Railway expenditures for improvement work and new equipment during 1922 and 1923 will represent a total of $1,540,214,000 according to figures compiled by the Bureau of Railway Economics and submitted at a conference of the American Railway Association with the Interstate Commerce Commission. Of this great total, 60 per cent is for equipment and 40 per cent for improvement works. In the latter class, track expenditures are far in the lead with a total of $237,429,000; shops, enginehouses, machinery, stations and docks come next with nearly $123,000,000; bridges and tunnels, $70,458,000; freight yards and water and coaling stations, $46,764,400; grade reduction, line revision and grade crossing elimination amount to $42,204,400. The itemized figures are given in the accompanying table:

Track	$172,564,398
Heavier rails	44,032,531
Additional ballast	16,378,947
Roadway machinery and tools	4,453,200
Bridges, trestles and culverts	60,010,400
Tunnels, subways and viaducts	10,448,000
Shops, enginehouses, machinery and tools	70,937,120
Stations and office buildings	33,365,500
Storehouses, elevators, coal and ore docks	14,411,500
Wharves, docks and piers	4,093,300
Classification yards	25,517,500
Water stations	13,537,300
Coaling stations	7,709,600
Grade crossing elimination and protection	21,781,700
Grade and curve reduction	20,422,700
Signals and interlocking plants	14,193,400
Telephone and telegraph lines	5,701,600
Electric power plants and transmission lines	5,592,900
Purchase of land and buildings	10,778,500
Miscellaneous	61,203,116
Total improvements	$617,194,218
Locomotives	$238,615,936
Freight-train cars	593,201,891
Passenger-train cars	68,819,005
Other equipment	22,383,369
Total equipment	$923,020,201
Total improvements and equipment	$1,540,214,419

Depreciation; a Definition

By Charles Hansel
Consulting Engineer, New York City

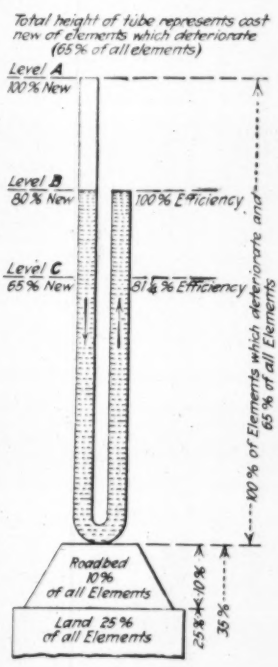
A *COMPOSITE Property* is one composed of two or more *simple properties* each of which can be replaced independently.

A *Simple Property* is one complete in itself—though in some cases possible of repair, which cannot be replaced practically by piecemeal but which should be replaced as a whole.

Depreciation as applied to a composite property, such as a transit company, is only that part of *deterioration* of the physical elements, if any, which has not been but which should have been restored seasonally or periodically in order to maintain an appropriate standard of operating efficiency.

Deterioration is the lessening of the useful life of a simple property due to impairment from any cause. It is subdivided into *permissible deterioration* and *depreciation.*

Permissible Deterioration or *Decretion* is that part of deterioration which has not been and which should not be made good because it has not reduced the property below an appropriate standard of operating condition.



The elements of the physical property of a traction property subject to deterioration are shown in the diagram attached, as in a state of flux, in a "U"-shaped tube, open at both ends, resting on the non-depreciable elements.

The solid portion of the tube shows the elements which deteriorate, kept at 100 per cent efficiency. The left leg above level *B* represents appropriate *"deterioration."* To keep a level of 100 per cent operating efficiency above 80 per cent of new would be economic waste; for, as illustrated by the right leg of the tube, the putting in of elements (money) at *A* will, so long as the level *B* is maintained, result in wasting at the level *B* without increasing operating efficiency. The deterioration from level *A* to level *B* should not be recouped by appropriate maintenance, but should be included in Rate Base.

Level *B* (20 per cent below level *A* or 80 per cent new of the elements which deteriorate) is the constant average condition above which it would be economic waste to attempt to maintain. It is the level of 100 per cent efficiency and stable condition. Unless this level is permanently lowered, no deduction should be made from condition new in fixing the amount upon which the owner should receive a reasonable return.

Level *C* is shown 35 per cent below condition new or 65 per cent new of the elements which deteriorate. This level *C* may properly be temporarily reached during the cycle of seasonal or periodical periods and does not necessarily indicate insufficient maintenance. If, however, this level is not seasonally or periodically raised to *B*, then the operating efficiency falls.

If level *C* is allowed permanently to remain, the owner having received in payment for service a sum sufficient (1) to give him a reasonable return on the value new, (2) to maintain the property at 100 per cent efficiency—i.e., level *B*; then, the owner should, at his own expense, bring the property back to level *B* and this cost should not be included in the Rate Base.

In using 80 per cent of new as the level of 100 per cent operating efficiency for the purpose of illustration, it should be understood that this per cent varies according to the requirements of operation. Some properties may be above and some below 80 per cent of new and yet be in 100 per cent operating condition for the service required.

Sacramento Paid for One-Third Weight-Gain of Garbage-Fed Hogs

PENDING the construction of an incinerator, the city-collected and delivered garbage of Sacramento is being fed to hogs on a 10-acre city-leased tract, 2½ miles from Sacramento, by a contractor who pays the city for one-third the net-weight gain of the hogs while they are being fed on garbage.

The wagons dump the garbage on the feeding ground, where it is spread out for the hogs by one or two attendants. Combustible residue is burned from time to time. The contractor must put the land in shape after hog feeding is abandoned. H. C. Bottorff, city manager of Sacramento, states that in June of this year about 700 hogs were being fed and that the city was receiving an average of some $450 a month as its share of the net weight-gain of the hogs. The hogs are weighed in and out, and monthly payments to the city are based on the public weighmaster's slips. This feeding plan was practiced about six weeks in the fall of 1922 but was stopped temporarily when wet weather made the road to the hog farm impassable. Feeding was resumed April 15 and will be continued until this fall, when it is expected that a new incinerator will be in operation. The amount of garbage ranges from some 60 tons in winter to 80 in summer. The population of Sacramento was 65,908 in 1920 and 44,696 in 1910.

Despite the fact that hog feeding is believed to be the most profitable form of garbage disposal, Sacramento city officials believe that it would be impracticable to continue this method of disposal long in view of the rapid settling up of territory adjacent to the city, which would make the operation of a hog farm objectionable at any point within economical hauling distance.

Appeal to Builders to Buy Out of Season

Franklin D. Roosevelt, chairman of the American Construction Council, has appealed to the building construction industry to buy as much material off season as possible, so that the railroads will not be swamped with building materials during the early part of the building period each year. He called attention to the practice of the American Radiator Co. of offering special discounts for deliveries made during off months, and recommends that this policy be followed by other concerns.

Tests of Five Models of Draft Tubes for Turbines

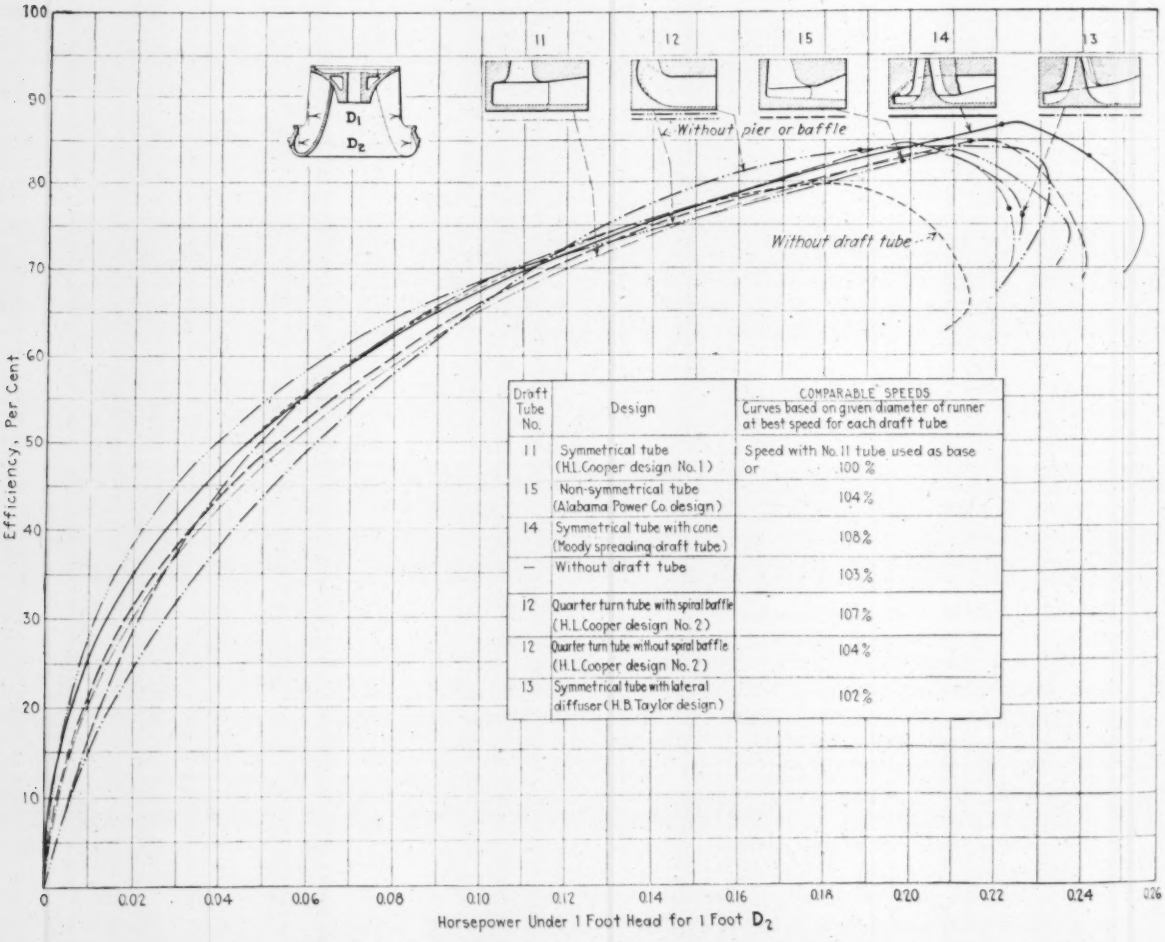
Made with Turbine and Tubes Geometrically Similar to Full-Sized Ones—New Symmetrical Type Superior to Older Forms

ONLY within recent years has it been realized that the setting of water wheels is almost as important as the design of the wheel itself in obtaining a maximum efficiency over a wide range of loads. In 1900 the largest wheel installed was of 5,000 hp. capacity and had an efficiency of about 63 per cent at 50 per cent of its rated power and an efficiency of 80 per cent at 100 per cent of its rated power, with the efficiency curve inclining sharply upward, indicating that the maximum would be obtained at considerably above the rated capacity of the machine, a point where the turbine was not intended to operate. Since that time improvements in the design of the runner as well as in the method of setting the wheels have made such strides that the efficiency of the 37,500-hp. unit installed by the Niagara Falls Power Company in 1919 and 1920 was 90 per cent at about 50 per cent of the full load, and also at the full load, and obtained a maximum efficiency of 93 per cent between 70 and 85 per cent of the rated load.

The straight-type draft tube was one of the developments which took place during the study of the turbine setting, but it was soon found that the cost of excavation necessary for such draft tubes was excessive. This led to the adoption of a bent type of tube. These bent tubes materially reduced the cost of installation, but were found to be seriously defective when efficiency was considered. In view of this fact and the fact that a gain of only a fraction of one per cent in efficiency of the output of the great modern turbines gives a large increase in output for a given amount of water, a great deal of careful study has recently been given to the development of symmetrical types of draft tubes that would regain both the axial and tangential components of the flow, and do so without excessive excavation cost.

The tests are reported in detail as follows in *Power*:

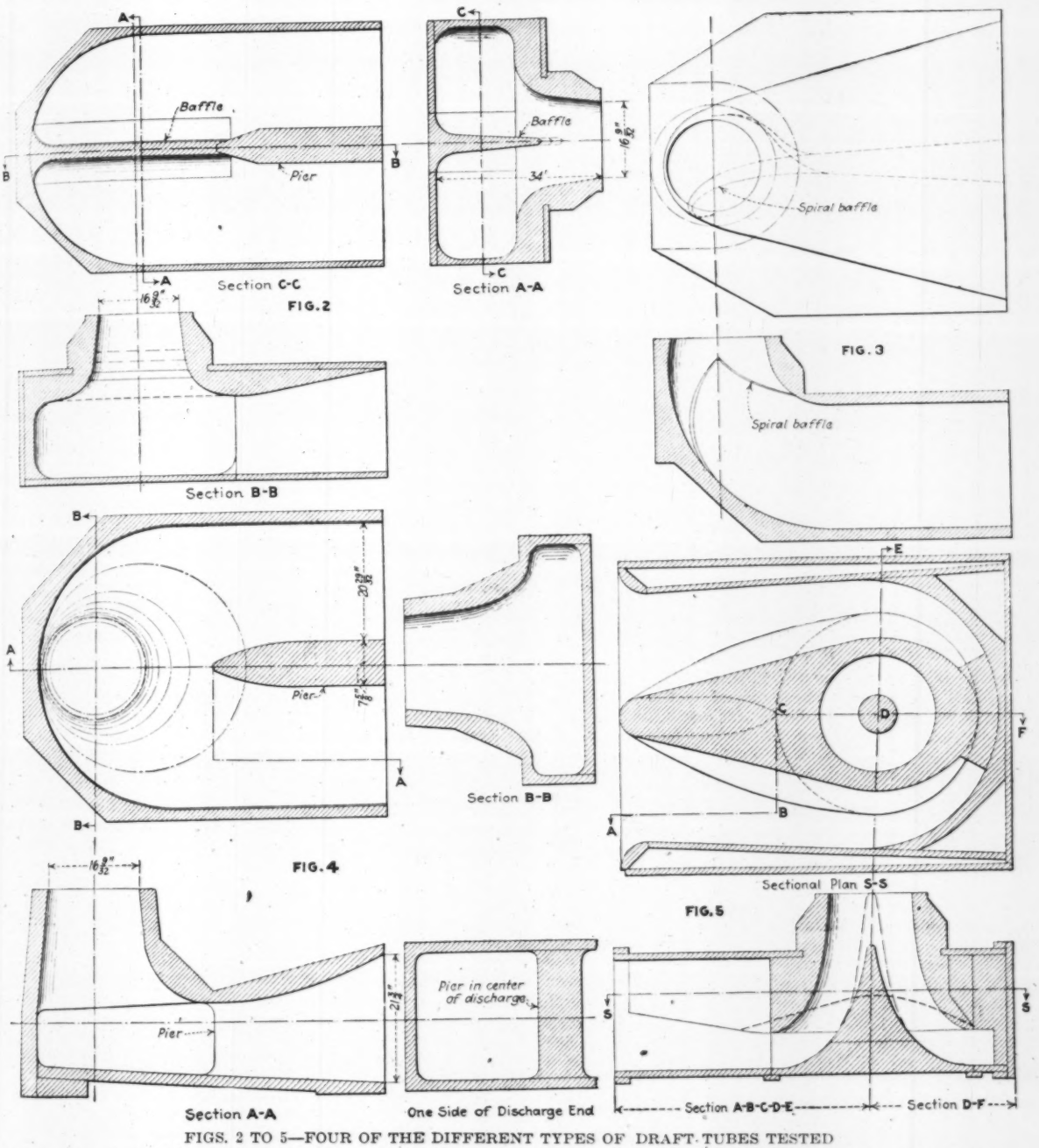
One of the symmetrical types is the hydraucone regainer developed by William M. White, manager, Hydraulic Department, Allis-Chalmers Co. Another type is the so-called spreading draft tube developed by Lewis F. Moody, consulting engineer, I. P. Morris Department, William Cramp & Sons Ship and Engine Building Co. In the latter the water passage is an annular space between an outer flar-



Draft Tube No.	Design	COMPARABLE SPEEDS Curves based on given diameter of runner at best speed for each draft tube
11	Symmetrical tube (H.L.Cooper design No.1)	Speed with No.11 tube used as base or 100 %
15	Non-symmetrical tube (Alabama Power Co. design)	104 %
14	Symmetrical tube with cone (Moody spreading draft tube)	108 %
—	Without draft tube	103 %
12	Quarter turn tube with spiral baffle (H.L.Cooper design No. 2)	107 %
12	Quarter turn tube without spiral baffle (H.L.Cooper design No. 2)	104 %
13	Symmetrical tube with lateral diffuser (H.B.Taylor design)	102 %

FIG. 1—RELATION BETWEEN EFFICIENCY AND HORSEPOWER OUTFIT

These curves represent the complete turbine under a given head at whatever speed is secured under the best conditions with each draft tube. They were approved and signed by H. Birchard Taylor, vice-president, Cramp Co.; Hugh L. Cooper; and Maj. Gen. Lansing H. Beach, Chief of Engineers, U. S. Army. The cross-section of the runner shown on this figure is not the Muscle Shoals, but has about the same specified speed and indicates the D_2 dimension.



FIGS. 2 TO 5—FOUR OF THE DIFFERENT TYPES OF DRAFT TUBES TESTED

Fig. 2—Sections through a symmetrical type of tube indicated as No. 11 on the curves. Fig. 3—Sections of a bent draft tube with a spiral baffle shown as No. 12 on the curves. Fig. 4—Sections through new type of bent draft tube and shown as No. 15 on the curves. Fig. 5—Sections through spreading type of draft tube indicated as No. 14.

ing wall and an inner core, in which the axial components of flow are gradually turned in the radial direction and at the same time are continuously reduced in magnitude.

When the designs were laid down for the government hydro-electric development at Muscle Shoals, a draft tube of the Moody spreading type was adopted from this particular installation by Hugh L. Cooper & Co., consulting engineers on this project. This type at that time was shown by tests on models to be the most economical from both an engineering and a financial viewpoint. Since then the development in draft-tube design has brought out other types that merited consideration, since under test for certain conditions they apparently showed the possibilities of a reduction in cost of construction sufficient to offset the difference in efficiency, as compared with the type adopted for the first four units to be installed at Muscle Shoals. This led to a series of tests being ordered by Maj. Gen. Lansing H. Beach, Chief of Engineers, U. S. Army, to be conducted on various types of draft tubes in the I. P. Morris laboratory for the War Department, under the supervision of Hugh L. Cooper & Co., consulting engineers. The purpose of the test was to secure a comparison of performance between types of bent tubes of simple design and comparatively easy and cheap to construct and some of the more

recent types which are highly efficient but involve expensive reinforced-concrete construction.

Model of High Specific-Speed Runner Tested—Tests were made of a model of a complete turbine equipped with a high specific-speed runner of the usual mixed flow, or so-called Francis type, similar to the 35,600-hp. units to be installed at Muscle Shoals, and with draft tubes geometrically similar to those that would be used in this installation. All parts of the turbine, testing flume and testing equipment remained the same in each test with the single exception of the type of draft tube provided, and each tube was designed to come within the same space restrictions. Tubes of five types were tested. These are shown on the curve sheet, Fig. 1, and in Figs. 2 to 5. No attempt was made to prove that one type was more efficient than another except for the condition in question.

Fig. 2 shows sections through a symmetrical type of tube indicated at No. 11 on the curve. As indicated by section *AA*, this tube had a vertical baffle that extended

COMPARABLE SPEEDS—FROM CURVES BASED ON THE SAME MAXIMUM CAPACITY OF TURBINE

Draft Tube No.	Design	Speed With No. 11 Tube as Base or 100 per Cent
11	Symmetrical tube (H. L. Cooper design No. 1)	100 per cent
15	Non-symmetrical tube (Alabama Power Co. design)	108 per cent
14	Symmetrical tube with cone (Moody spreading-draft tube)	115 per cent
—	Without draft tube	101 per cent
12	Quarter-turn tube with spiral baffle (H. L. Cooper design No. 2)	109 per cent
12	Quarter-turn tube without spiral baffle (H. L. Cooper design No. 2)	107 per-cent
13	Symmetrical tube with lateral diffuser (H. B. Taylor design)	103 per cent

well up into the neck of the tube, otherwise the construction was similar to a short conical type with a vertical pier in the center of the horizontal discharge section. As might be expected, this tube showed up poorly in efficiency, probably owing to the short length of the tube and the baffle directly under the discharge from the turbine, causing turbulence which prevented the water from flowing readily from the tube.

In Fig. 3 are given sections of a bent tube with a baffle in it. This baffle might be considered as an extension of the vertical pier in the horizontal section of the tube, which is given a 90-deg. turn as it approaches the bottom of the turbine's casing and extends up to within about three inches of the runner. At this point it is reduced to a thin edge at right angles to the pier in the horizontal section of the tube. This type of tube with its 90-deg. spiral baffle showed considerably better results than design No. 11, between 50 per cent load and normal rated power of the turbine. However, below 50 per cent load the efficiency fell off rapidly and showed a lower efficiency at light loads than any of the other types tested. Tests were made on this tube with the spiral baffle and the pier removed, which made the tube similar to the ordinary bent type. Under this condition from about 60 per cent full load to normal rated capacity the efficiency is lower than with the baffle. Below 60 per cent load the efficiency holds up better than with the baffles and from 50 per cent load down shows a better efficiency than any of the other types tested.

Design No. 15 is of a type similar to that developed for the Mitchell Dam project of the Alabama Power Co. and is shown in section in Fig. 4. The curve of this type falls in an intermediate position in regard to those of the other types. Although in these tests this tube shows a lower turbine efficiency by about 2 per cent than model No. 14, which is the Moody spreading type, on a prior test made at Worcester, Mass., on a tube of a design similar to No. 15, and under conditions similar to those at Mitchell Dam the difference in efficiency was not so great. In fact, the results of the Worcester tests led to Hugh L. Cooper & Co.'s carrying on the tests at the direction of the War Department to make sure that the advance in draft-tube design had not produced a type more economical than that available at the time the Muscle Shoals project was first decided upon.

Two sectional views of a model of the type of spreading tubes to be used at Muscle Shoals are shown in Fig. 5. Between 40 per cent and 100 per cent load, or throughout the usual operating range, this tube shows better turbine efficiency, does this with the turbine operating at a higher speed, and the turbine develops from 6 to 14 per cent more power than with any of the other types.

A test was also made on a model tube having a lateral diffuser as shown at 13, Fig. 1. This arrangement gave an efficiency inferior to some of the other models. Each curve represents the run secured under the best conditions for that tube.

Referring to Fig. 1, the curves represent the relation between the total efficiency and the horsepower output of the complete turbine under a given head at whatever speed is secured under the best conditions with each draft tube. The curve shown in dotted lines represents the performance of the turbine without any draft tube. In this test the runner discharge passed into a wide chamber, the discharge from this chamber being submerged below the tailwater surface so that there was no loss of static head on the turbine. The difference in turbine efficiency of 7 per cent and over 19 per cent in power capacity shows clearly the effects of equipping the turbine with an efficient type of draft tube.

The curves show that with a turbine designed for a suitable power output and a suitable speed, the spreading draft tube would exceed the others not only with respect to peak efficiency, but also for efficiencies at powers throughout the ordinary operating range; namely, from 40 to 99 per cent of the rated full load.

It might be mentioned that draft tube No. 14 was tested both with a high cone, as indicated on the curve, and with a somewhat lower cone, and the comparison resulted in favor of the high cone, although the difference was not great in this case. The advantage, however, of the higher cone in most installations is that it results in higher efficiency and also produces quieter and steadier conditions of flow. In the ordinary types of draft tube the center is occupied by turbulent water not partaking of the general stream-line flow, and under extreme conditions there may be a cavity filled with air or vapor at this point, a condition which is removed by filling this region with a solid core. This arrangement not only eliminates certain internal conditions, but also, through the removal of inertia effects in the center of the draft tube, prevents them from being transmitted to the penstock, which in some installations has resulted in water hammer or surging involving pressure rises as high as 25 to 35 lb. per sq.in. The 70,000-hp. units being built for the Niagara Falls Power Co. will be equipped with draft tubes with the cone extending to the runner. The same remark applies to the new 58,000-hp. unit No. 6 for the Queenston station of the Hydro-Electric Power Commission of Ontario. The use of a cone even of moderate height in the draft tube has shown a marked effect in producing steady conditions and in preventing inertia effects, and apparently the logical procedure is to run the cone to the runner.

These tests represent a contribution to a phase of turbine design which in the past has been neglected. When we consider the effort that has been expended on the part of the hydro-electric industry to secure increases in turbine efficiencies of fractions of one per cent by improvements in runner design, it is manifest that improvement in the efficiency of the turbine as a whole by improving the draft tube is equally important. The draft tube of a turbine must be designed to take care of a complex condition of flow, and each installation requires special treatment and study, and it cannot be said that results arrived at in one condition are applicable to another without giving the particular flow involved in the draft tube due consideration.

Waltham Reservoir Waterproofed by a New Lining

Disintegration of the Reinforced Concrete Due to Seepage and Frost Action Makes More Waterproofing Necessary

By M. W. Fisher
Engineer, The Texas Co., Asphalt Sales Department, New York City

In spite of the elaborate precautions taken at the time of construction to make the concrete in the Waltham, Mass., reservoir watertight, both by careful proportioning and the addition of integral waterproofing compounds, it has since developed so much seepage that it has been necessary to resort to additional waterproofing to save the structure from disintegration due to frost action. This has been successfully accomplished by relining the sides of the reservoir.

The standpipe was built in 1906. (*Engineering Record*, Jan. 12, 1907, p. 32.) It is 100 ft. in diameter, 43 ft. high, and has a capacity of 2,000,000 gal. The side walls are of reinforced concrete 18 in. thick at the bottom, rising with a constantly battered outside face to a 12-in. thickness at the top. The concrete was carefully proportioned to obtain the best mechanical mixture for the filling of the voids, and hydrated lime in the proportion of five per cent of the weight of cement was added to it. The first 10 ft. of the inside wall was plastered with mortar containing an integral waterproofing compound, and the remainder received at least two brush coats of a similar mixture. (*Engineering News*, Sept. 19, 1907, p. 310.)

In 1914, an ill-advised attempt was made at waterproofing by the application of a coat of pitch to the inside wall. This amounted to very little and another attempt was made shortly afterward by the application of cement, using a cement gun, on the outside. Neither of these methods proved satisfactory, the seepage continued and successive frost action caused several large areas of the outside wall to disintegrate, the surface breaking in several places to such an extent that the reinforcing rods were exposed.

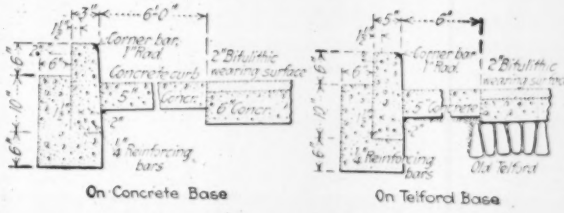
During the summer of 1922 it was decided to reline the reservoir. After the contract for the waterproofing had been let and all details arranged, the standpipe was emptied and the inside wall thoroughly cleaned and dried, a number of salamanders being used to hasten the drying. When the walls were thoroughly dried, the waterproofing was started. It consisted, first, of a mop coat of Texaco No. 56 waterproofing material applied hot to the inside face of the wall. Immediately over this was applied a coat of waterproofing felt, the surface of the same being mopped with another coat of Texaco No. 56 waterproofing asphalt. This operation was repeated for five layers, the outside layer, however, being of six-ounce saturated duck fabric, and the outside surface of this finally mopped with the waterproofing asphalt. Immediately following this, a 4-in. brick facing was constructed from the floor to the top of the wall, great care being taken to obtain a one-half-inch mortar course between the outside asphalt course and the inside face of the brick work. All of this work was started at the bottom and built up for the entire inside circumference of the wall in 6-ft. sections.

The work was started Nov. 20 in spite of the inclement weather and was completed and the reservoir refilled on Dec. 23. As the stagings on the side of the wall were taken down, the whole inside face of the brickwork was thoroughly cleaned by washing.

Simpson Brothers of Boston were the general contractors on the work, W. A. Murtfeldt Co. of Boston, sub-contractor on the waterproofing, and M. F. Stankard of Waltham, sub-contractor on the brick work. The engineer's estimate on the whole of this work was $16,500, while the low bid of the contractor was $16,543.

Concrete Parking Strips on Asphalt Streets

Concrete side strips on widened gutters are being employed at St. Louis, Mo., in pavement reconstruction on streets where asphalt or other bituminous surfacing is adopted. These strips are 6 ft. wide and permit an automobile to be parked parallel to the curb and entirely clear of the bituminous roadway. It has been found on asphalt streets that the parts next to the curbs, due to the hindrance of parked cars, do not get the traffic needed to keep them ironed down in the best



CONCRETE PARKING STRIPS FOR BITUMINOUS PAVEMENT

condition. Also the traffic traveling a narrow center lane intensifies the danger of rutting and shoving. With the concrete parking strips, the full width of asphalt is clear for traffic and the distribution of traffic is reasonably uniform. Standing water is kept pretty well off the bituminous surface. The construction of the side strips corresponds closely to the regular city requirements for concrete curb and gutter.

The design is shown by the illustrations from an improvement on Russell Ave. A detail to be noticed is the use, where it was a part of the old pavement, of the Telford base as a sub-base for the new pavement. By carefully cleaning the surface of the old Telford a very satisfactory bond of the new concrete base and the stone sub-base is secured. W. W. Horner is engineer of the Board of Public Service of St. Louis.

Accelerations in Airplane Maneuvering

Measurements of the accelerations of an airplane in various complex maneuvers, recently made at Langley Field by F. H. Norton and T. Carroll for the National Advisory Committee for Aeronautics, are summarized in Report 163 of the committee. The plane used was of SE5A type; a three-component accelerometer and a recording air-speed meter were used. The maneuvers were a loop, a spin, a roll, a right and left wing-over turn, a side slip and a skid. The maximum normal acceleration (vertical for plane in usual position) was 3.80 times the acceleration of gravity, and occurred in a loop. The greatest lateral accelerations occurred in a spin and a side slip, reaching 0.35 and 0.40 times the acceleration of gravity respectively. The greatest longitudinal accelerations were 0.50 in a loop and a roll, and 0.60 in a wing-over.

Earth Moving Methods and Costs, Bronx Parkway

Record of Dragline, Steam Shovel and Heavy Tractor Operations Covering Four Years of Miscellaneous Earth Moving

By Gilmore D. Clarke
Superintendent of Construction, Bronx Parkway Commission, New York

Approximately 1,500,000 cu.yd. of earth moving, with a variety of machines, has been accomplished largely during the last four years in building the Bronx River Parkway north from New York City. Construction by force account made close cost records possible and the variety of operations and the special character of the work give these records exceptional interest. They represent a quite different situation than exists in normal drainage ditching and railway grading operations.

The lands in the Bronx River valley were acquired by the Bronx Parkway Commission, first for the purpose

WALKING DRAGLINE WIDENING RIVER CHANNEL INTO A LAKE

of preventing the pollution of the Bronx River, which before public ownership was virtually an open sewer, and second as the route for a parkway connecting the New York city park system with the watershed lands in upper Westchester County. The reservation is approximately 16 miles long and varies in width from 200 to 1,200 ft., terminating at the Kensico Dam. Work was begun in 1916 and continued until the war, little being accomplished during 1918. Operations were resumed in the summer of 1919 and during 1920, 1921 and 1922, general grading work was brought very nearly to completion.

Outline of Operations—The engineer's studies showed that it was necessary to lower the water level of the river throughout a greater part of its length in order to build a drive which would require a minimum amount of fill to bring it at all times of the year above flood level. To obtain enough material to bring the driveway to subgrade, and to grade adjacent areas to conform to proper landscape treatment, it became necessary in places to build lakes by means of which a large amount of fill was obtained. Most of the material for the drive and adjacent grading was taken from river and lake excavation and inasmuch as wet material was to be handled, machinery adapted for that particular kind of work was obtained. Conditions in the valley were at most times unfavorable for the type of machinery used by contractors in this part of the country and after canvassing the situation thoroughly it was decided that the work could be most economically prosecuted by force account.

The parkway parallels a line of the New York Central R.R. and in many places the river is close to the railroad embankment. Where this was the case the river was moved away to permit trees and shrubs to be planted to screen out the railroad right-of-way. The old river varied in width up to 30 ft.; the new channel was made 40-ft. wide at the lower end, narrowing to about 20 ft. toward the upper end near the Kensico Dam.

Dragline Performance—In 1917 a walking dragline excavator was purchased. This machine was adapted for excavation from below water level and was capable of standing upon rather soft marshy ground. It was equipped with a 40-ft. boom, a 1-cu.yd. bucket, a 45-hp. gasoline engine and a device for "walking" which it was believed would make it possible to work where no other excavating machine could work. It had a circular base about 12 ft. in diameter and when ready to move, two large pads, one on each side, were lowered to the ground and by means of revolving cams the machine was raised, took a step of about 4 ft., and assumed working position again. This outfit had its limitations, however. The gasoline engine caused constant vibration and when standing upon soft ground, the machine gradu-

TABLE I—RECORD OF DRAGLINE EXCAVATION, BRONX PARKWAY

Year	Cubic Yards Excavated, Rehandled, or Loaded—Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total	Total Cost	Unit Cost
Walking 1 Cu.Yd.															
1917	Total for year											71,717	71,717	$11,967.00	
1918	Total for year											44,657	44,657	7,659.00	
1919	1,170	4,500	3,938	6,391	7,875	3,870	6,367	6,840	6,926	10,584	4,946	2,183	65,590	10,836.82	
1920				5,792	10,220	10,305	9,054	9,923	9,936	2,474		2,026	59,730	19,103.29	
1921	4,368	1,468	6,913	5,151	7,166	5,889	939	7,567	7,137	3,834	6,057	.....	56,489	11,959.46	
1922	973	.....	3,169	5,012	2,277	2,423	2,433	2,926	.....	.....	.....	.....	19,213	5,969.19	
													317,397	$67,494.76	$0.212
Walking 2 Cu.Yd.															
1920	.....	.....	.....	.....	6,255	21,710	27,227	23,566	22,462	22,594	13,821	10,957	148,592	22,309.29	
1921	2,250	.....	11,943	4,414	14,583	9,932	10,052	13,437	20,590	14,513	11,498	10,485	123,697	19,020.48	
1922	.....	.....	7,985	8,955	12,534	13,590	4,725	10,935	12,875	14,895	8,910	6,930	102,334	17,057.30	
													374,623	58,387.07	$0.155
Traction ¾ Cu.Yd.															
1920	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	2,085	7,222	9,307	1,521.75	
1921	3,187	.....	.....	7,738	912	7,879	7,003	13,066	6,600	5,819	5,962	4,940	63,106	11,154.43	
1922	.....	.....	5,026	8,564	7,526	4,953	6,972	11,221	9,408	9,542	7,678	4,991	75,881	10,738.20	
													148,294	$23,414.38	$0.157
Traction ¾ Cu.Yd.															
1921	1,549	1,307	2,943	4,242	3,749	5,157	6,582	6,657	5,154	5,397	3,282	6,726	52,745	12,365.99	
1922	3,565	.....	.....	4,221	2,927	3,566	3,172	5,914	6,327	1,704	371	405	32,172	10,115.12	
													84,917	$22,481.11	$0.264
Totals	17,062	7,275	41,917	60,480	76,024	89,274	84,526	112,052	107,415	91,356	64,610	173,236	925,227	$171,777.32	$0.185

DRAGLINE ON CRAWLER TRACTIONS DEEPENING RIVER

ally worked itself into the mud, and if operated in such a position the weight of the bucket and load often caused one side to settle. When this occurred, the cams were brought too low to engage the pads and the machine was unable to "step." Then quantities of brush or heavy plank were used on the soft places to provide a bearing.

Excellent service was given by this dragline, it having excavated, rehandled, and loaded in five years (Table I) 317,397 cu.yd. at a cost of $67,494.76, or a cost per cubic yard of $0.21. This included the cost of the machine, fuel, oil, repairs, overhauling, operators, and two helpers necessary for each shift. When one considers that there is from one to three months' shut-down in winter; that, during the spring, work proceeds slowly on account of the condition of the ground, and further the unavoidable delay of loading teams through a hopper, this cost seems very favorable. The given yardage is computed from the bucket loads, not from yardage in place.

Early in 1920 a larger walking dragline was purchased as one of the sections to be developed in New York City and which the commission desired to complete in one year, required that approximately 140,000 cu.yd. of material be moved. Also there were no trees in the section to interfere with the operation of a large machine. The specifications were: Weight, 80 tons; boom length, 60 ft.; power, one 70-hp. Charter engine, single horizontal cylinder; fuel, kerosene; traction, the same as for the small dragline previously described, and bucket, 2 cu.yd. This machine was placed on two eight-hour shifts and in eight months during 1920 it excavated and rehandled 149,562 cu.yd., which cost $20,105.56, or $0.135 per cubic yard.

Steam Shovel Operation—Until the fall of 1919 no shovels for loading had been purchased and the dragline loaded teams through a hopper. This process was uneconomical; it was difficult to move the hopper and the output of the dragline was cut down due to the delay of the teams. It was also found impossible to load wet material excavated directly from river and lake and placed into the hopper and the dragline therefore rehandled material previously excavated and spoiled in piles, this material having had a chance to dry.

Realizing the necessity of a more economical means for loading teams, a revolving shovel, equipped with a ¾-cu.yd. bucket and with caterpillar traction, was purchased. This machine worked three years and during the time loaded 155,661 cu.yd. for a total cost of $36,370.13, or $0.233 per cubic yard. This machine has also been used in the construction of dry rubble retaining walls and when engaged on such work the shovel boom was removed and replaced with a 30-ft. lattice boom.

Supplementing the work of the 2-cu.yd. walking dragline were two revolving shovels with ¾-cu.yd. buckets, used to load teams or trailers drawn by tractors, for the final placement of the excavated material. These shovels, together with another shovel of a similar type and two small draglines, were received from the Bureau of Public Roads, being engineer equipment declared surplus by the War Department in 1919 and made available to the states for road construction work.

During a period of 7 months in 1920 the two shovels, working with the 2-cu.yd. dragline, loaded 93,761 cu.yd. of material from spoil piles made by dragline. The total cost of operation, depreciation, fuel, etc. was $14,497.27, the cost per cubic yard to load being $0.154.

Tractor Haulage Operations—As operations moved north through the reservation, hauls became longer, much too long to use teams economically. Motor trucks could not be used on account of the soft ground and the nature of the material to be hauled. In some places the best kind of sand and gravel for road fill were found

TRACTOR TRAINS HAULING SPOIL TO FILLS

and in other places a heavy blue clay, which when compacted was impervious to water. This clay was used to build the long flat slopes from the driveway to meet the existing grade, and the sand was saved for road fill.

The long-haul problem was solved when in the spring of 1920, eight 10-ton artillery tractors were received from the government. These machines were new and were placed in service immediately. Fifteen 1½-cu.yd. bottom-dump wagons were arranged into five trains of three wagons each and each wagon was loaded to full capacity and hauled by tractor. These tractors are ordinarily capable of hauling four trailers, but due to the heavy drag through wet clay three were all the tractors could haul economically. The following year, 1921, when hauling conditions were more favorable due to better ground, four trailers were used.

During two seasons' work seven 10-ton tractors hauled a total of 130,573 cu.yd., the total cost of operation being $46,456.12 and the cost per yard $0.355. The operating cost includes winter overhauling, a total expenditure

for parts and supplies of $8,523.86 and overhead charges of eight per cent. Seven tractors travelled a total of 13,771 miles and required a total of 42,380 gal. of gasoline, giving a total of 3.07 miles per gallon of gasoline. The average cost of gasoline over two seasons was $0.246. The cost per mile to operate the tractors was $3.37. Spare parts and supplies made up about one-sixth of the operating cost.

The high cost of spare parts was due partly to the fact that the workmanship and materials on war made machines were inferior to those in the product on the market today, and due also to the high prices charged for spare parts. The tractors were subjected to hard usage, however, and hauled material through soft clay where no other vehicle could operate. Teams would have been out of the question in places where tractors operated successfully. In places where the ground was particularly soft, limbs of trees were placed across the tractor as a sort of corduroy, thus enabling the machines to keep on the surface and providing better traction. Often when the trailers sank deep into the mud it became necessary to uncouple the tractor and have it pull the trailers out by means of a cable 30 ft. or more in length. By this means, the tractor was often able to pull on ground giving better traction and was prevented from grinding itself deeper into the mud. For long hauls, those over ¼ mile, the tractor has proven the most economical method for hauling large quantities to fill.

Small Dragline Performance—The two steam draglines which were received from the government were equipped with 45-ft. booms and ¾-cu.yd. buckets and were suitable for the work of widening and deepening the river channel, stripping topsoil, and lake excavation. These machines have small cabs and are more suitable for work around trees where working space is limited.

Due to the swampy nature of the ground over which one of these machines was required to travel a set of six pontoons was built, each being 4 ft. 8 in. x 6 ft., of 3 x 8-in. oak plank spiked together and having a cable loop in the center to make handling easy. With these pontoons these draglines were capable of excavating through soft undrained swamp where it was thought no excavating machine could travel until the swamp was drained. These two draglines have excavated and rehandled a total of 233,211 cu.yd. in two years at a total cost of $45,895.49, the unit cost being $0.196.

General Summary—In a period of six years over 1,500,000 cu.yd. of material were excavated, rehandled, or loaded, in the construction work on the Bronx Parkway Reservation. The tables herewith show the number of cubic yards each machine handled, the total cost, and the unit cost. It will be noted that the average unit cost for shovel and dragline excavation is the same, 18½c.

The yardage does not represent the number of cubic yards measured in place, but a count of buckets of each machine given daily by each operator who was supplied with a counter for the purpose. The total yardage thus obtained was reduced by 10 per cent, the result being accurate enough for purposes of comparing the performance of one machine with another.

In considering the unit costs it should be kept in mind that in landscape development a certain amount of fussy work is necessary which adds materially to the cost. It is necessary to strip topsoil before cuts and fills are made and pile it in storage piles to be saved for replacement after subgrading work is done. Shallow cuts and fills are necessary and trees must be preserved.

The reader must take these facts into consideration before comparing the costs presented herewith with the costs for drainage ditch work, railroad cuts and fills and other heavy grading of a similar nature. Naturally the costs on these projects of a purely engineering nature are considerably lower. Altogether, however, the results show that the commission was amply justified in its decision to accomplish the large amount of grading work by force account rather than by contract.

The Bronx Parkway Commission consists of Madison Grant, W. W. Niles and Frank H. Bethell. Jay Downer is chief engineer and L. G. Holleran the deputy chief engineer.

TABLE II—RECORD OF STEAM SHOVEL EXCAVATION, BRONX PARKWAY

Year	Cubic Yards Excavated and Loaded — Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total	Total Cost	Unit Cost
							¾-Cu.Yd. Shovel								
1919										2,084	5,003	1,058	8,145	$3,325.25	
1920	561				620	11,477	7,017	7,731	11,573	9,986	5,581	4,948	59,494	$11,392.06	
1921	5,655			1,965	1,738	8,164	6,471	7,211	5,059	6,702	6,653	5,516	55,134	11,810.61	
1922			1,788	2,378	1,976	3,153	7,758	8,243	5,950	1,642			32,888	9,842.21	
													155,661	$36,370.13	$0.233
							½-Cu.Yd. Shovel								
1920						1,551	3,066	8,036	7,735	6,908	10,489	9,950	47,735	7,200.14	
1921	5,723			2,392	3,524	3,516	4,055	4,587	5,239	6,971	4,764	1,382	42,153	12,401.04	
1922			499	3,157	3,760	5,420	4,494	9,596	4,479	6,096	12,827	4,182	54,510	8,120.93	
													144,398	$27,722.11	$0.192
							¼-Cu.Yd. Shovel								
1920						1,897	7,430	5,836	4,846	11,936	7,863	6,218	46,026	7,297.13	
1921	8,147		258	1,269	4,964	10,417	4,452	6,977	6,412	7,581	6,227	5,961	62,665	10,945.66	
1922	5,789	786	2,169	5,910	10,122	857	6,149	4,587	8,362	9,273	11,801	6,545	72,350	8,448.97	
													181,041	$26,691.76	$0.147
							¼-Cu. Yd. Shovel								
1920													780.38		
1921					2,332	10,912	7,961	10,577	6,179	4,454	10,287	8,324	61,026	7,994.37	
1922	2,545	197		5,591	7,759	5,000	2,865	3,839	8,496	4,107	4,319	2,869	47,587	10,560.94	
													108,613	$19,335.69	$0.177
							All Shovels								
Totals	28,420	983	4,714	22,662	36,795	62,364	61,718	77,220	74,330	77,740	85,814	56,953	589,713	$110,119.69	$0.186

Forestry on New England Water-Works Lands

Reforestation of lands owned to protect public water supplies in five of the six New England states (Rhode Island not included) covers 12,220 acres and 15,261 acres more are available for planting. The total area of water-works lands owned by the eighty-odd works reporting the foregoing figures is 98,020. Details are given in paper by Philip W. Ayres, forester of the Society for the Protection of New Hampshire Forests in the *Journal* of the New England Water Works Association for June.

Federal Valuation of Railroads in the United States

Railroad Engineers Must Keep Valuation Records Up to Date—Value Affects Various Phases of the Railroad Problem

By Edwin F. Wendt
Consulting Engineer, Washington, D. C.

Abstract of a paper presented at the Annual Convention of the American Society of Civil Engineers, at Chicago, July 11-12.

The success of federal regulation of railroads will depend in large measure upon the valuation of the properties engaged in the service of the public. The Valuation Act, Section 19a of the Interstate Commerce Act, approved March 1, 1913, provides that: "The commission shall investigate, ascertain and report the value of all the property owned or used by every common carrier subject to the provisions of this act."

Engineering Board—The commission promptly within the sixty days prescribed, organized a Bureau of Valuation in charge of a director. The engineering board, appointed May 1, 1913, consisted of five members, and the United States was divided into five districts: Eastern, Central, Southern, Western and Pacific, each including approximately 50,000 miles of railroads. This board held its first meeting on May 6, 1913, and the last on Sept. 22, 1920. Each district had a technical staff including a civil engineer in charge of roadway and track; bridge engineer in charge of structures; architect in charge of buildings; mechanical engineer in charge of locomotives, cars and shop machinery; electrical engineer in charge of power plants and electric traction; signal engineer in charge of signals and interlocking plants; telegraph and telephone engineer in charge of telegraph and telephone work. There was also a complete office organization for the assembling of all the data into final engineering reports.

The engineering board during its existence of 8½ years to Oct. 31, 1921, supervised the work of inventorying the entire 250,000 miles of railroads in the United States. This work was done in great detail. The length of every road, including the various main tracks, spurs and sidings, was measured by engineering corps. All excavations and embankments were cross-sectioned and computed. Bridges, buildings, signals, water stations, fuel stations, shops, roundhouses, turntables, cars, locomotives, shop machinery, signals, interlockers, telegraphs, telephones, gas plants, power plants, and all appliances of every kind and description were inspected, measured, enumerated and computed in accordance with the standard practices of the engineering profession.

The field work of making the inventory measurements, and the office work in connection with the computations, collections and assembly of the quantities of the different classes of property was done with such care and thoroughness that both the carriers and the public have been well satisfied with the results of the work. Great care was exercised in the preparation of the instructions which regulated the work of the field engineers. The maximum force of engineers, accountants and land appraisers engaged at one time on this work was 1,500, and the engineering profession may well feel proud of the accomplishment of the great task of collecting the fundamental data required by the Valuation Act.

Date Basis of Prices—Having completed the essential engineering data, the commission proceeded to price the engineering works on the basis of prices as of June 30, 1914. The selection of this date was in some respects accidental, since the valuation forces were assembled in 1913-1914, the World War had not begun, and it was thought that the economic level of prices at that time would constitute a fairly stable basis upon which to determine the value of railway property so far as rate making was concerned. But the war radically changed the situation and even after five years of peace the economic level of wholesale prices is 60 per cent above that of 1914. The Supreme Court has pointed out in the Southwestern Bell Telephone Case, 1923, that proper weight should be given to present prices.

Final Value—The Interstate Commerce Commission has issued a large number of tentative final valuations, and the valuation work has reached a stage where it is possible to precast the relation of final value to the investment accounts. Obviously the present value of some carriers is higher and of other carriers lower, than the investment account. However, speaking generally, it is highly probable that the aggregate values of the railroads, as found by the Interstate Commerce Commission, will substantially equal the capitalization. The commission in 1920 held that the tentative final aggregate value of the steam railroads is $18,900,000,000, and this value, which is the rate-making value, is very close to the investment shown on the books. When the final aggregate value of all property of the railroads has been determined, the prospects are that the "present value" will be substantially the present total capitalization.

This being the case: What will be the effect of federal regulation upon the future development of railroad? The commission controls the issuing of future railroad securities, the regulation of car supply and distribution, the joint use of terminals, the construction of new lines and the abandonment of old lines. The commission is required to prescribe rates so as to enable the carriers to earn an aggregate annual net railway operating income equ to a fair return on the aggregate value of the railway p perty used in transportation. The commission decided in 1922 that 5¾ per cent is a fair return. Thus the value of the property is fundamental, whether the question is a schedule of rates, capitalization, consolidation, depreciation, recapture of excess railway operating income, joint use of terminals, construction of new lines or division of joint rates.

Future Valuation Work—All regulation is to be based upon a consideration of the property, its nature, classification extent, use and value. The railways will find it necessary to maintain adequate technical staffs for constantly studying the value of the property in its relation to the above items and other phases of the regulatory problem. It will be necessary for them to do more work in the line of scientific research, and to submit the data to the commission. Thus there is a large field of usefulness for the engineer, accountant, statistician and economist.

The effect of future regulation will depend, in large measure, upon the thoroughness of the study of the various phases of the railway problem. The commission is obliged by law to predicate its decision upon the record developed at hearings, but the Transportation Act places such a great burden upon the commission that it will not be possible for its forces promptly to prepare the data needed. Therefore it will be necessary for the railways to furnish information essential for proper decision in the various issues which will grow out of the interpretation and enforcement of the Transportation Act. These issues involve the prosperity of one of the three greatest industries in America, the railway business with a capitalization of $20,000,000,000.

The public interest requires a reasonable regulation of the transportation business, and the people are well satisfied with private ownership of railways under public regulation.

Rural Whole-Time Health Officer Service

Of a rural population of 51,406,017 in the United States, 5,957,616 or 11.58 per cent have the services of whole-time health officers, according to figures given in a paper by Dr. W. F. Draper, assistant surgeon general, U. S. P. H. S., in *The American Journal of Public Health* for June. Nineteen states have no such officers, including New York, New Jersey, Michigan and Minnesota. Vermont has 100 per cent, Ohio has 53.37 per cent, North Carolina has 39.75 and Alabama 36.50 per cent of its rural population under the care of whole-time health officers.

St. Louis Tests Three Water-Main Joint Materials

Cement and Leadite Superior to Lead for Resistance and Deflection, While Lead and Leadite Are More Readily Worked

BY LELAND CHIVVIS
Engineer-in-Charge, Distribution Section, Water Division, St. Louis, Mo.

WATER-WORKS engineers have, in general, attacked the problem of electrolysis by devising either methods of preventing the return current from leaving the circuit over which it is intended to travel, or means by which the return current, once it had leaped to the pipe line, could be induced to leave it in an orderly manner at the end of its journey. In the first class are such devices as welded rail joints and insulated negative returns, and the effort to keep the potential gradient as low as possible by restricting the area supplied by any one power station. In the second class is the familiar expedient of bonding the pipes to the rail or direct to the negative bus bar. Most of us have neglected the obvious course of discouraging current flow on our pipes by making them as near non-conducting as the available materials will permit. We have continued to use a material in the joints which is a better electrical conductor than the cast iron itself when there were available a number of other jointing materials which are very fair insulators.

The purpose of this paper is to describe tests made by the St. Louis Water Division to show the comparative electrical resistance of lead, cement and leadite in a bell-and-spigot joint and to determine their ability to withstand deflection. Three 50-ft. lines of 3-in pipe were laid on supports and capped at the ends. Corporation cocks were inserted for filling and draining. One line was jointed with lead, a second with leadite and after waiting a month for weather suitable to making cement joints, the three lines were brought indoors as shown by the accompanying sketch. The cement joints were made by driving in two strands of regular oiled jute filling with stiff neat cement and ramming this home with a follower of a third strand of jute, finishing with the jute flush with the bell. A beveled collar of neat cement was added partly for appearance and partly to aid in permeating the third jute ring. The lead and leadite joints were made according to standard practice.

After about two weeks' time a six-volt automobile battery was coupled up with a resistance, a voltmeter and an ammeter (see sketch), contact points were filed on each side of the joints, the pipes were filled with water and the tests shown by the table were made.

The resistance of the pipe body between the joints is negligible as it is equivalent to a copper cable ⅜-in. in diameter. It will be noted that some of the overall resistances (joints 1 to 4 inclusive) do not check the sum of joints 1, 2, 3 and 4 taken individually under the same conditions. This can only be explained by assuming faulty contacts where the resistances seem unduly high. If work of this kind is ever attempted again we intend to drill and tap the pipe and solder all wires. The results show that on a leadite or cement line most joints have 500 or 600 times the resistance of a standard lead joint.

After the electrical tests were completed the lines were again put under pressure and some very severe deflection tests were made by alternately hoisting and lowering at the mid-section and again at one end.

The cement and leadite joints stood this treatment very well, the leakage being practically nothing although the visible part of the jointing material cracked and even spalled off in the case of the cement. Lead joints 2 and 3 leaked badly and had to be recalked before the test had gone very far. Joint 3 finally squeezed out of the bell about an inch and would have blown out if the volume of water behind it had been anything larger than the capacity of the ¾-in hose used for filling.

The lines were now leveled on supports and time taken for the removal of the jointing material. The six lead joints were burned out by one man with an oxy-acetylene flame in ½ hr.; the leadite was burned out by the same man in 1 hr., the increase in time being due to the sulphur fumes. The six cement joints were gouged out by two men in 3½ hr. of very tedious work.

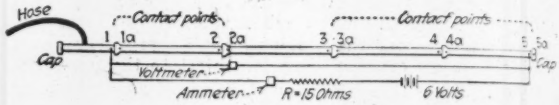
A summary of the results follows:

1. *Cement and Leadite* are far superior to lead as insulators. The insulating value of these materials is not vitiated by the water in the pipe.

2. *Cement and Leadite* will stand far more deflection than lead without serious leakage.

ELECTRIC-RESISTANCE AND DEFLECTION TESTS ON CEMENT, LEADITE AND LEAD-JOINTS IN CAST-IRON PIPE

Three-parallel lines of 3-in. pipe, each 50 ft. long, with electric contact points, as shown in the sketch immediately below, were tested (1) with the pipes full, under pressure, and then (2) with pipes empty but otherwise under same conditions as (1). The results of (1) indicate that the water conducts very little current around the joints.



Contacts on Points	Current Flow Amp. (I)	Potential Difference Volts (E)	Joints	Resistance Ohms (R=E/I)
Pipes Full and Under Pressure				
Cement Line				
1, 5	0.08	5.0	1, 2, 3, 4	62.5
3, 5	0.27	2.4	3, 4	8.9
1, 1a	0.2	3.2	1	16.0
2, 2a	0.22	3.2	2	14.5
3, 3a	0.28	1.6	3	5.7
4, 4a	0.42	0.45	4	1.1
5, 5a	0.31	1.6	5	5.2
Leadite Line				
1, 5	0.10	4.3	1, 2, 3, 4	43.0
3, 5	0.23	3.1	3, 4	13.5
1, 1a	0.22	3.1	1	14.0
2, 2a	0.41	0.01	2	0.02
3, 3a	0.11	3.0	3	27.2
4, 4a	0.42	0.2	4	4.8
5, 5a	0.23	3.1	5	13.5
Lead Line				
1, 5	0.45	.05	1, 2, 3, 4	.1
3, 5	0.45	.01	3, 4	.02
1, 1a	0.45	.01	1	.02
2, 2a	0.45	.01	2	.02
3, 3a	0.45	.01	3	.02
4, 4a	0.43	.01	4	.02
5, 5a	0.44	.01	5	.02
Pipes Empty				
Cement Line				
1, 5	0.08	5.2	1, 2, 3, 4	65.0
3, 5	0.26	2.6	3, 4	10.0
1, 1a	0.18	3.8	1	21.1
2, 2a	0.19	3.6	2	19.0
3, 3a	0.26	2.6	3	10.0
4, 4a	0.46	0.01	4	0.02
5, 5a	0.30	2.3	5	7.7
Leadite Line				
1, 5	0.05	5.5	1, 2, 3, 4	110.0
3, 5	0.23	3.1	3, 4	13.5
1, 1a	0.15	4.2	1	28.0
2, 2a	0.14	4.4	2	31.4
3, 3a	0.23	3.0	3	13.0
4, 4a	0.46	0.01	4	0.02
5, 5a	0.18	3.9	5	21.7
Lead Line				
1, 5	0.46	0.02	1, 2, 3, 4	0.04
3, 5	0.46	0.02	3, 4	0.04
1, 1a	0.46	0.01	1	0.02
2, 2a	0.46	0.01	2	0.02
3, 3a	0.46	0.01	3	0.02
4, 4a	0.46	0.01	4	0.02
5, 5a	0.46	0.01	5	0.02

3. *Lead and Leadite Joints* can be made in any season and under adverse conditions, while cement is under a disadvantage in winter and in wet trenches.

4. *Lead and Leadite Joints* permit the water to be turned on and the line put in service immediately, while cement requires a period of preliminary setting.

5. *Cement Joints* are very hard to gouge out.

CEMENT, LEAD- AND LEADITE-JOINTED 3-IN. CAST-IRON PIPE UNDER DEFLECTION TEST

6. *The Sulphur Fumes of Leadite* might become very oppressive in a confined working space.

These tests were made by men thoroughly conversant with the use of lead who were staunch in its support until the rising price made the substitutes look attractive. St. Louis is now preparing to lay a considerable amount of small pipe with cement joints and if lead does not drop appreciably before winter we will probably try leadite during the freezing weather.

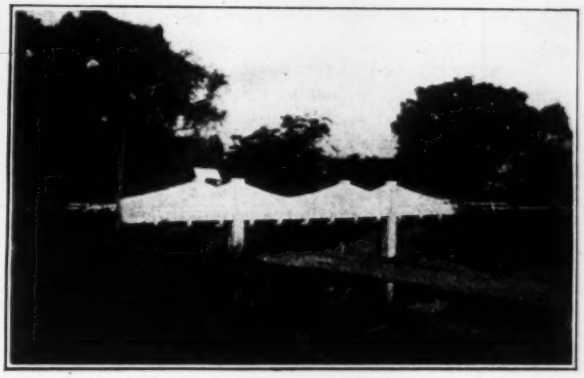
Cantilever Bridge of Concrete

Monolithic Structures Supported on Piers—Heavy Abutments Not Required—Clear Channel Span of 51 Ft.

By Paul M. Henry
Bridge Engineer, Ohio State Highway Department

In connection with the improvement of the Newark-Mt. Vernon intercounty highway in Ohio, two reinforced-concrete bridges of an interesting design have been built. One is over the Clear Fork and the other over the Lake Fork, in Licking County. Both bridges are of the reinforced-concrete cantilever type of 54-ft. span, the only difference in them being in the height of their piers.

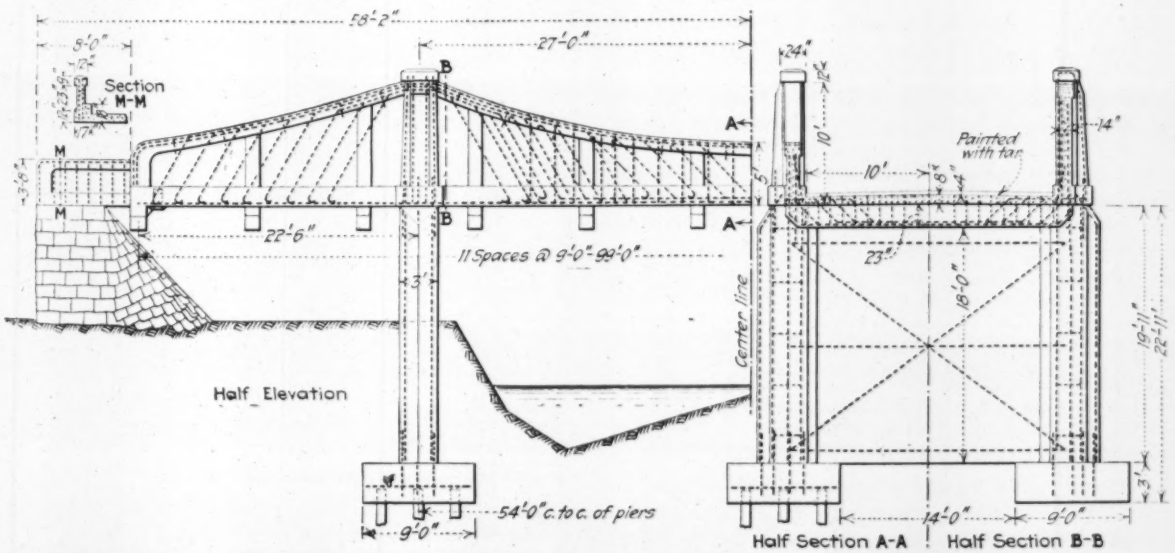
The bridges were designed to carry a 15-ton truck. The floor-beams carry the floor and load and transfer it to the girders at the floor-beam points as concentrated loads. Influence lines were used to determine loadings for maximum stresses. To avoid the use of construction joints in the main structure the floor and two main girders of each bridge were poured in one



CANTILEVER CONCRETE BRIDGE FOR OHIO HIGHWAYS

operation. The approach slabs at each end of the structures were poured later. The top of the floor-beam at each end of the cantilever was provided with a half-round groove 4 in. deep, for the entire width of the roadway, to support the approach slab. This groove was painted with a coat of bituminous material before the slab was poured. The design called for the outer end of this slab to rest on the fill, but in construction it was provided with a shallow foundation 3 ft. deep and 1½ ft. thick.

The Newark Paving & Construction Co. which had the contract for the entire improvement, both road and bridges, sublet the bridges to B. C. Patterson at approximately $13,000 each.



ELEVATION AND CROSS-SECTION OF CONCRETE CANTILEVER BRIDGE AT LAKE FORK, LICKING CO., OHIO

Undiscovered Substratum of Peat Complicates Foundation Job

Shallow Foundations Settle During Construction—Original Borings Inaccurate—Unusual Method of Underpinning

SETTLEMENT of the foundation during the construction of a ten-story building due to the use of inaccurate borings which presumed to indicate the character of the material underlying the site, has forced the builders to resort to an unusual method of underpinning the foundation of the Westinghouse Electric & Manufacturing Co. building in Philadelphia. At the time the property was purchased by the present owners they received from the former owners a series of borings which indicated that a loose fill 8 to 10 ft. deep and a uniform bed of clay and sand was all that overlay the rock, which was about 45 ft. below the surface. These borings were accepted by them as being accurate and a shallow pile foundation was put in.

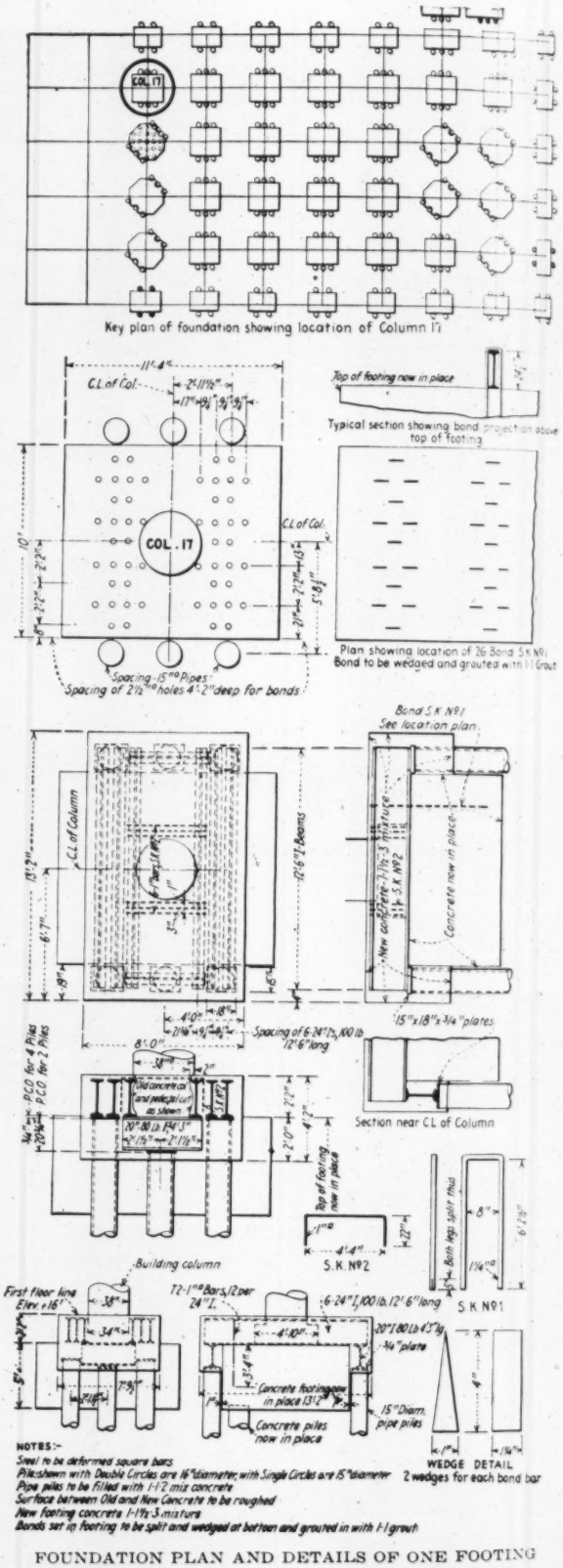
When construction work was started the Raymond Concrete Pile Co., subcontractors under the Hughes-Foulkrod Co., drove test rods to determine the length of piles required. The test rods were driven to a depth of from 25 to 30 ft. at which depth the penetration of the test rods indicated that piles would sustain the contemplated loading. When the actual piles were driven, their length and resistance closely agreed with what was to be expected from the driving of the test rods and the boring records.

The driving of the piles for the footings was completed and eight of the stories of the building had been erected when a considerable settlement over a large part of the foundation area was noted. The building construction was immediately stopped and core borings were taken. These borings showed that, except under the two rows of footings at the west side of the building, the first 25 to 30 ft. of material was about as indicated in the original boring record, but that underlying this layer of clay and sand was a very compressible layer of peat and silt. Under these circumstances each individual pile developed sufficient resistance to carry its assumed loading, but when the weight of the building was put upon all of them it developed compression in the stratum of peat which resulted in a settlement varying from about 4 in. at the east side of the building to nothing at the west side. The piles at the west side where there was no substratum of peat carried their load without settlement.

In order to further verify the result of these core borings, the contractors had an open-end reinforced-concrete caisson with an inside diameter of 4 ft. sunk to bedrock and completely excavated. The excavation disclosed the following layers of sub-soil:

27 ft. of fill
4 ft. of peat
1 ft. of gravel
15 ft. of silted peat
8 ft. of silt
2 ft. of coarse sand and gravel on top of very hard mica schist

In the meantime, in order to avoid undue settlement during the underpinning operations, each column was shored up. It was necessary to take the shores up several times a day to compensate for the continuous compression of the soil on which they bore.


Key plan of foundation showing location of Column 17
COL. 17
C.L. of Col.
Top of footing now in place
Typical section showing bond projection above top of footing
Plan showing location of 26 Bond S.K. N°1
Bond to be wedged and grouted with 1:1 Grout
Spacing 15" ø Pipes
Spacing of 2½" ø holes 4'-2" deep for bonds
Bond S.K. N°1
See location plan
C.L. of Column
12'-6" L Beams
Concrete now in place
New concrete 1-1½-3 mixture
S.K. N°2
15"x18"x¾" plates
Spacing of 6-24"□, 100 lb 12'-6" long
Section near C.L. of Column
PCO for 4 Piles
PCO for 2 Piles
Old concrete cut and wedged out as shown
Top of footing now in place
S.K. N°2
Bars hgs split thus
S.K. N°1
Building column
First floor line Elev. +16'
72-1" ø Bars, 12 per 24" L
6-24"□, 100 lb. 12'-6" long
Concrete footings now in place
Concrete piles now in place
15" Diam. pipe piles
WEDGE DETAIL
2 wedges for each bond bar
NOTES:-
Steel to be deformed square bars
Piles shown with Double Circles are 16" diameter, with Single Circles are 15" diameter
Pipe piles to be filled with 1-1-2 mix concrete
Surface between Old and New Concrete to be roughed
New footing concrete 1-1½-3 mixture
Bonds set in footing to be split and wedged at bottom and grouted in with 1-1 grout

FOUNDATION PLAN AND DETAILS OF ONE FOOTING

Showing location of the new piles in relation to the original footings and method of transferring the load to them.

The method of underpinning the foundation is shown in the accompanying drawing. Each footing is supported on a group of 15-in. or 16-in. concrete filled steel pipe driven to rock outside the original footing. These pipes were sunk without removing any of the floors of the building which had already been placed. When each pipe had been firmly bedded on the rock it was cleaned out with compressed air blown through a 2½-in. nozzle at 110 lb. pressure, sealed with neat cement, and concreted up to the cutoff elevation. These pipes were then capped with short steel I-beams. Steel beams with their outer ends resting on these caps were placed across the top of the original footings. The footings were then suspended from these overlying girders by means of 1¼-in. deformed U-bars which were split and wedged at the bottom and securely grouted in place. After this concrete had been allowed to set for ten days steel wedges and shims were placed between the U-bolts and the I-beams, and between the caps and the top of the concrete-filled pipes. The whole footing was then completely encased in concrete.

SETTLING FOUNDATION CARRIED BY CROSS BEAMS

The underpinning described was designed and executed by the Raymond Concrete Pile Co., following the requirements of the Philadelphia building department. Percival M. Sax acted as consulting engineer to the contractors. Application has been made for patents on this method of construction.

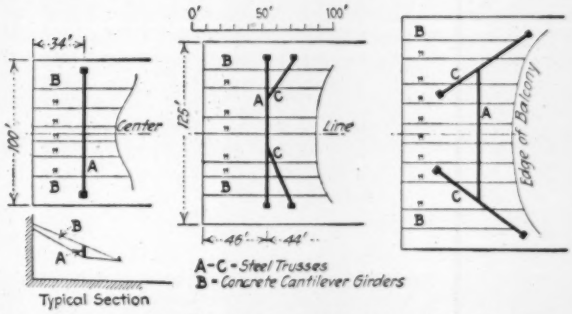
Engineering Charges on Local Improvement Work

A bill permitting municipalities to include engineering and inspection as items in the cost of local improvement work has been passed by the Illinois state Legislature, largely through the efforts of the Illinois Society of Engineers. No percentage is fixed by the law, but this is left to the decision of the municipalities. According to a statement in the 1923 *Proceedings* of the society this bill was the outcome of a decision by the Illinois Supreme Court in 1922 to the effect that engineering and inspection during the construction of improvements by special assessment are not a part of the cost of the work. This decision operated to the disadvantage of many improvements in the smaller municipalities, few such municipalities having corporate funds out of which to pay these expenses. It operated also to the serious disadvantage of engineers for such work. Since nothing more could be accomplished through the courts, the next step was to get the legislature to amend the statute so as to provide specially for these items, and this has now been done.

Truss Supports for Cantilevers of Theater Balconies

IN THE structural design of large modern theater buildings a typical feature is the introduction of long steel trusses as fulcrum bearings for inclined concrete girders supporting the balcony floor. This arrangement eliminates intermediate columns in the main floor and provides an unobstructed view. Difficulties in location and design of the trusses are encountered, especially the difficulty of combining long span and shallow depth in the steel trusses, a condition involving heavy members.

Three different arrangements of balcony trusses are shown in the accompanying drawing. Plan No. 1 shows the simplest arrangement, as used in the Keith Theater at Euclid Ave. and 17th St., Cleveland, the anchor span single steel truss, *A*, of 87-ft. span, supported on interior columns, carries the six inclined concrete girders, *B*, which have a maximum cantilever length of 33 ft. and an anchor span of about 34 ft. Owing to the limited



TRUSS AND CANTELEVER FRAMING OF BALCONIES

depth of truss the necessary amount of material for the required strength is obtained by using a twin truss, with parallel double chords and web members.

In plan No. 2, which represents the Palace Theater at Euclid Ave. and 17th St., Cleveland, the anchor span of the concrete girders, *B*, is about 46 ft., while the maximum projection beyond the truss, *A*, is about 44 ft. Since this distance would be excessive for a cantilever, two diagonal trusses *CC*, are introduced, having their inner ends framed into the main truss, *A*, and their outer ends supported by side columns. Owing to the interior arrangement these diagonal girders are not symmetrical, one being 39 ft. and the other 49 ft. long. In this way the cantilever lengths of girders *B* are only from 27 to 30 ft. This theater construction was described in *Engineering News-Record*, June 22, 1922, p. 1036, and the truss arrangement is like that of the State-Lake Theater, Chicago (see July 24, 1919, p. 178.)

A more complicated arrangement was required to meet the conditions of architectural design in the Chicago Theater, Chicago, as shown in plan No. 3. In this case columns could not be placed at suitable points for supporting the truss *A*. Two 76-ft. diagonal trusses, *C*, were therefore placed on side columns, and the 88-ft. truss, *A*, was framed between them. This is a twin truss, similar to that in plan No. 1, but a more effective distribution of metal is effected by the use of an H-section for each of the four chords, thus permitting the use of as many vertical cover plates as desired.

The architects for the three theaters were C. W. and George L. Rapp, Chicago, and the structural designs were by Lieberman & Hein, engineers, Chicago.

Letters to the Editor

This department aims to be a forum for the discussion of the views of engineers and contractors. The range of interest should be as wide as possible. Contributors are, therefore, asked to make their letters short.

Trial of Acid in Dewatering Imhoff-Tank Sludge at Plainfield, N. J.

Sir—Experiments on sludge dewatering with sulphur dioxide gas were mentioned by J. R. Downes, superintendent, Plainfield sewage-works, in your issue of July 5, p. 29. The sulphur dioxide conditioning process is controlled by this company and has been in successful operation on activated sludge for some time at the Houston, Texas, and Gastonia, N. C., plants.

The process was installed experimentally at a small sedimentation plant in the Borough of Brooklyn, New York City, and produced favorable indications. This plant was moved to the Plainfield, N. J., sewage-works in the late fall of 1922 with the understanding that one of the Imhoff tanks would be cleaned out for the purpose of delivering an undigested sludge to the experimental dewatering plant. Due to lack of sludge bed facilities, the Plainfield people were unable to clean out a tank and deliver fresh sludge, so we were compelled to attempt to handle digested Imhoff sludge with a high proportion of colloidal solids. Despite the fact that the particular machine set up at Plainfield was not designed to handle this type of sludge, fairly good indications were developed, although the experiments had to be discontinued before any conclusive data could be collected, due to cold weather with attendant difficulties.

This company has issued no data on results produced with any other sludge than activated, but feels that this brief statement covering the Plainfield experiment should be forthcoming in view of the possibly misleading communication from Mr. Downes.

R. H. EAGLES,
Sanitary Engineer, Maclachlan Reduction Process Co., Inc.

New York City,
July 10.

State Highways in Small Towns

Sir—I disagree with the editorial entitled "Off Into The Mud" in the June 14 issue of *Engineering News-Record*, in which you state that the small towns in the Northeastern states are conspicuous for their poor pavements, and that these pavements should be brought up to the standard of the state highways.

I am a resident of one of the small towns in question, in which the pavements are generally in the condition you refer to, particularly on the street where I live, which, although a side street as far as the town is concerned, is now a connecting link in the state highway system. A few years before the highway was built this street was paved with a waterbound macadam and of recent years it has been frequently oiled to keep it in shape.

Under normal conditions this pavement would have served us for a good many years, but with the vast stream of automobile traffic, including large trucks of a number of apparently very prosperous concerns now in the business of handling freight over the state highways, the pavement of this street has been almost entirely broken down. Quite naturally we are not inclined to spend more money on rebuilding this street, particularly as the estimated life of the original pavement is not up yet, and bonds are still in existence. Also, from a selfish point of view, the present condition of the pavement insures a safe rate of speed for the passing automobiles, in a street where we have no money to provide traffic policemen, and consequently have to cross at the risk of our lives.

In view of all this I do not see why we should be called upon to repave this street for the benefit of this state and interstate traffic, and particularly for the benefit of the trucking concerns that are getting rich competing with the railroads that have to maintain their own "running lines" as our British friends would say. It seems to me that it would be more fair to the people of the small town, who get little benefit from this traffic, if the state highway pavements were carried through such towns with only a small percentage of the cost assessed against them.

"ENGINEER."

Balanced Bids—Duty of the Engineer

Sir—I have read with interest and approval the letter from E. T. Thurston of San Francisco, in *Engineering News-Record*, July 5, regarding "Unbalanced Bids," and the reason therefor, and wish to concur with him in his statement urging the engineers and architects of the country to base all estimates on experience of such work as is being estimated.

If every engineer and architect would write his specifications with due regard to the actual operations necessary to perform the work, and make the plans for such work conform in every respect to the shape and finish of the completed work, he would not only save his client money but would make his own position more secure with both the owner and the contractor; for an honest and competent contractor will do better work and can do it for less money when the man in charge is just as experienced in the actual operations of the work to be performed as is the contractor himself, and there will be very little chance for differences to arise as to the interpretation of the specifications when they are written with both technical and practical knowledge.

To-day the majority of the contractors are, or have employed as their superintendents of construction, graduate engineers, so it behooves the engineer to wise himself up on the "way to do" as well as "how to do" every kind of work on which he proposes to write the specifications and supervise the construction.

As Mr. Thurston so aptly states, every engineer and architect who undertakes conscientiously to give his client the same degree of responsible service as he demands that the contractor give such client, must secure himself in the position to provide that contractor with as nearly perfect plans and specifications as is humanely possible.

W. D. HOWREN,
Consulting Engineer.

Amarillo, Texas
July 16, 1923.

Seek Apprentices in the Field Operations

Sir—Your editorial, "Who Restricts Apprentices," p. 45, issue of July 12, 1923, while exonerating the labor unions would have been more to the point if suggesting to the contractors to look for the fault in the field operations.

The writer, who for the past fifteen years has been connected with the largest contractors of Philadelphia and Washington, D. C., has never been discouraged either by the contractors or labor unions from trying out intelligent boys as apprentices.

Generally the plan followed when employing large or small forces of common laborers was to hire a few well developed boys as laborers and, if found industrious and capable of holding down a common laborer's position, after a few weeks they were allowed to try out as apprentices. This plan generally succeeded, for the boy had to have the grit to stand up under a constant fire of being hurried under a labor foreman which helped to weed out the laggard and find the boy who was fit to keep pace with the mechanics foremen.

Further the boy was allowed to assist in the engineering work that each operation required. If the boy was found exceptional he made the grade of foreman in a shorter time than the average slower mechanic, thus developing a supply of mechanics who could always make good when called upon to shoulder some of a field operations responsibility.

Personally I feel that a little propaganda at the field operations will produce more apprentices—as when boiled down to facts the boys are available—if the job superintendents would go a little out of their way to produce them and to oversee their progress.

THOMAS F. MACDEVITT,
Construction Superintendent,
Washington, D. C.

July 23, 1923.

News of the Week

CURRENT EVENTS IN THE CIVIL ENGINEERING AND CONTRACTING FIELDS

News Brevities

A survey of the New York elevated railways is to be made by George F. Swain, professor of civil engineering at Harvard University. This work has been authorized by the New Municipal Transit Bureau. Prof. Swain was chairman of the Boston Transit Commission for five years and is a past president of the A.S.C.E.

To Mark the Completion of the Alaska Ry., President Harding recently drove a gold spike at the Tanana Bridge. The citizens of Anchorage presented the spike to Col. Frederick Mears in appreciation of his work as builder of this 471-mile line between Seward and Fairbanks.

A New Traffic Ordinance for New Orleans has been compiled by Commissioner Ray of the Department of Public Safety and will be presented to the Commission Council for adoption. This new traffic code includes regulations needed by local conditions and those successfully tried out in other cities, and will relegate to the discard many antiquated ordinances.

The Indiana State Highway Department Must Have, according to John D. Williams, director, 10 more engineers, 20 more state road inspectors and 30 more county road inspectors on the construction of 235 miles of roads of which 170 miles will be hard surface, 35 miles of secondary type and 30 miles improved by grading and building structures. State inspection is in force on forty-one county projects, consisting of 125 miles of road improvements, to cost approximately $2,254,000.

Authority to Construct 380 Miles of Railroad from Tucumcari, N. M., to Seymour, Tex., and from Perrin to Fort Worth, with a possible addition of 100 miles to the above has been asked of the Interstate Commerce Commission by the Texas, Panhandle & Gulf Ry. Co. The company has also applied for authority to buy or lease the tracks of the Gulf, Texas & Western R.R. Co. from Seymour to Salesville in Palo Pinto County.

An Application for a Rehearing in the assigned car case has been made to the Interstate Commerce Commission by the various subsidiaries of the U. S. Steel Corp. The petition points out that none of the coal mined by the applicant mining companies is sold in competition with coal mined in the same or adjacent districts, that the nature of the manufacturing process requires a continuous operation of a steel plant, and that the distance between the plants and their coke ovens on the one hand, and the mines on the other, requires the use of private cars to insure continuity of the coal supply.

Moffat Tunnel Bids Wanted

The Moffat Tunnel Commission will receive bids Aug. 25, 1923, for the excavation work on the main and pioneer tunnels for the Denver & Salt Lake R.R. under James Peak in Grand County, Colo. The tunnels will be 6.04 miles long and at 65-ft. centers. The main tunnel will be 16x 24 ft. and the pioneer tunnel will be 8x8 ft. Cross headings between the tunnels are to be cut at as many points as the contractor finds desirable. The $6,750,000 bond issue has been sold at a substantial premium, the contract for supplying electric power to the two portals has been let, and the installation of equipment is now in process. R. H. Keays is chief engineer, and V. A. Kaufman is resident engineer.

Bridge Design Dispute Initiated by Architects

Supplementing the statement published last week (p. 155) as to the controversy over the design of the three new Allegheny River bridges which are to be constructed in Pittsburgh, it is reported that the controversy originated with demands on the part of architects that the board of county commissioners turn over the design and supervision of the bridges to them. John W. Beatty, director emeritus of the Department of Fine Arts, Carnegie Institute, appeared before the board and made such a demand. Subsequently a committee of the Pittsburgh chapter of the American Institute of Architects came before the board to support the Beatty demand. As a result of this meeting the commissioners asked the committee to supply a list of the names of local architects competent to take charge of such bridge construction. The controversy incidentally has included such misleading statements as that an architect designed the Manhattan bridge over the East River at New York.

Penn State College to Train Industrial Executives

Pennsylvania State College, through its industrial engineering department, offers a special summer course of two weeks to industrial executives. For seven years, under the leadership of such engineers as Hugo Diemer, a group of industrial executives have met for two weeks at State College and through intensive study, lecture and laboratory work have gone into the field of costs, rate setting, personnel, planning and production with a view to training in executive co-ordination. Each year about twenty-five leading plants have been represented. This summer the course is given in the industrial engineering laboratory from Aug. 27 to Sept. 8. Information may be secured from J. O. Keller, Head, Industrial Engineering Dept., State College, Pa.

Bids Received for Steelwook on Philadelphia-Camden Bridge

Bids were opened by the Delaware River Bridge Joint Commission on July 18 for construction of the two inclined steel bents carrying the cable saddles at the anchorages of the Philadelphia-Camden suspension bridge. Two bids were received as follows:

	Steel Lbs.	Bethlehem Steel Co.	American Bridge Co.
Silicon Steel	2,030,000	9.1 c.	9.3 c.
Carbon steel	650,000	8.7 c.	9.3 c.
Cast steel	950,000	15.0 c.	11.7 c.
Steel supports for bents	200,000	7.9 c.	8.1 c.
Total		$399,580	$376,590

Although underbid on every item except that for cast steel, the American Bridge Co. was low bidder and its proposal was accepted by the commission.

The bents are inclined steel supports to hold the cables in position and to deflect them downward for their anchorage into the masonry. Each bent has two columns, 7 x 8 ft. in section, of cellular construction, braced together by diagonal and cross members, and carrying saddles in which the cables will rest. Saddles and column bases are cast steel. The columns are silicon steel, of the same grade as that being used in the main towers of the bridge, (yield point 45,000, ultimate strength 80,000 to 95,000, pounds per square inch). The column bases rest upon inclined surfaces of concrete at the river end of each anchorage. Bearing on the concrete will be effected by grouting. The total force to be carried by each bent, under maximum conditions, amounts to 48,400,000 lb.

The contract time for completion of the bents is nine months, but the contractor is required to have them in condition to permit stringing of the cables in eight months.

Federal Judge Rules City Cannot Extend State Traffic Law

Judge Robert S. Bean, U. S. District Court, sitting at Portland, Ore., has decided that a city or municipality has no right to add to or extend a state law on any subject. The opinion arose from a situation wherein A. F. Davidson, a motorcycle policeman, sued Walnorth & Co. because of injuries suffered in a collision with an automobile owned by the defendant company. The policeman charged that he had the right-of-way because of an emergency while in the discharge of his duty. The state law lists certain vehicles and occupations which are given rights-of-way so far as traffic is concerned but motorcycles are not included in the state law. However, the city of Portland's ordinances do include motorcycles as well as other fire and police vehicles as having special traffic privileges.

The court decided that the complainant based his suit upon an extension of a state law and therefore the case was thrown out of court on a technicality.

Rapid-Transit Agreement in Philadelphia

City and Traction Company Work Out Subway and Elevated System Costing 60 Millions

After discussions extending over more than a year, agreement has virtually been reached on plans for rapid-transit development in Philadelphia. These plans are in effect changes in the Taylor Plan, adopted by the city in 1916. Work on certain portions of the subways included in that scheme had been started when increasing costs caused by war time conditions forced postponement of construction.

Recent discussions have centered principally upon the number of tracks to be constructed in Broad St., the terminal points for that line, and the disposition to be made of the loop subway for delivery of Broad St. subway traffic in the center of the city. Injected into the discussions has been the political feud between the mayor and the majority faction in city council.

The plans upon which agreement now seems likely provide for a comprehensive scheme of development, and for a first step in that scheme. A four-track subway is provided in Broad St. from Olney Ave. south to Spruce St., approximately eight miles, with a two-track subway extending south from Spruce St. to the Navy Yard at League Island. A two-track subway is provided in Ridge Ave., leading from the Broad St. line to Eighth St. and then by way of Walnut and Chestnut Sts. to a point in West Philadelphia near 42nd and Chestnut Sts., continuing from that point as an elevated line to the southwestern portion of the city and to Darby. A surface-car subway is provided in Chestnut St., in which it is proposed to run all surface cars now operating on Chestnut and Walnut Sts., thus leaving those streets free for motor traffic. This feature is one of great importance in view of present congested conditions on these streets. Subway lines are provided in Arch and Filbert Sts., with connections to the Delaware River bridge (under construction) to Camden, and with extensions as elevated railways to Overbrook and to Roxborough.

The first step in the plan, which is designed for immediate construction, comprises the Broad St. subway from Olney Ave. to Spruce St., together with the Ridge Ave., Eighth St. and Walnut-Chestnnut St. subways, and the elevated railway to the southwest and Darby. The estimated cost of this portion of the work, as computed by engineers of the Philadelphia Rapid Transit Co., is given in the table.

	Structure	Trackwork	Equipment	Cars	Total
4 Track Subway—Broad. Olney to Spruce	$34,240,000	$2,900,000	$4,440,000	$9,220,000	$50,800,000
2 Track Subway—Ridge. Broad to Eighth	3,540,000	210,000	330,000	670,000	4,750,000
2 Track Subway—8th. Race to Walnut	2,580,000	110,000	160,000	350,000	3,200,000
2 Track Subway—Walnut, Chestnut 8th to 23d	6,110,000	310,000	480,000	1,000,000	7,900,000
2 Track Bridge and Approaches—Chestnut, 23d to 30th	1,400,000	60,000	90,000	200,000	1,750,000
2 Track Subway—Chestnut, 30th to 42d	3,960,000	280,000	410,000	850,000	5,500,000
2 Track Elevated—42d. Woodland, Chestnut to Darby	4,880,000	820,000	1,270,000	2,630,000	9,600,000
Totals	$56,710,000	$4,690,000	$7,180,000	$14,920,000	$83,500,000
Terminal Yards and Shops					6,500,000
GRAND TOTAL					$90,000,000

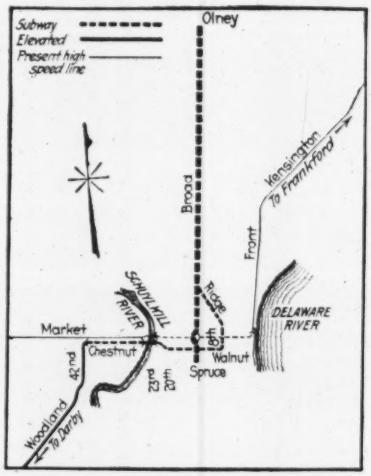


FIG. 1—PROPOSED FIRST STEP

City council special transit commission has indicated approval of this plan. Suggestions have been made for minor changes on the Darby line, one plan being for a continuation of subway construction in the 42nd St. portion from Chestnut St. to Woodland Ave., and another being for extending the Chestnut St. portion to 46th St. and then turning south to Woodland Ave.

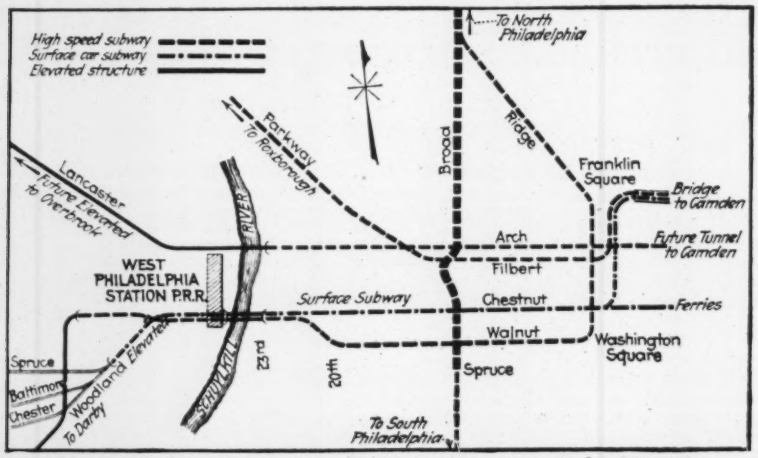


FIG. 2—PROPOSED COMPREHENSIVE PLAN FOR PHILADELPHIA TRANSIT DEVELOPMENT

This plan includes the following changes from the plans adopted by the city in 1916: (1) Inclusion of surface subway and high-speed connection to the Delaware River Bridge, which had not been started at the time the 1916 plans were developed; (2) abandonment of the plan for a "delivery loop" in the central section of the city as a terminal for the Broad St. line, and (3) the construction in its place of the Ridge Ave. line. This arrangement permits of through routing on all lines.

This portion of the plan was incorporated in an ordinance which was passed by the city council at a special meeting held on July 27th. The ordinance also provides for the reapportionment of the funds already voted for subway construction. The special session was held in order that there may be time to repass the measure, in case it is vetoed, in time to submit it to vote at the primary election in September.

The Philadelphia Rapid Transit Co. has offered to pay sinking fund and interest charges on the money required for the Chestnut St. surface car subway so that its construction will not encumber the borrowing capacity of the city. An ordinance covering the construction of this subway is being prepared for submission to the people at the general election in November.

The contract for the construction of 1529 ft. of two track subway in Arch St. between Eighth St. and Thirteenth St. was awarded on July 27th to the Keystone State Construction Co. for $1,198,555. This section of subway under Arch St. is a portion of the "delivery loop" and is not included in the first step of the council's construction program.

New Orleans Zoning Ordinance Legal Says High State Court

The right of New Orleans to exclude business enterprises from residence districts through zoning was upheld by a unanimous decision of the seven judges of the Supreme Court of Louisiana in a decision handed down on July 11. Brief excerpts from the decision, given in the New Orleans *Item* of July 12, indicate that the court went so far as to hold that the exercise of the police power in zoning may be extended to esthetic considerations in so far as these include eyesores in residential districts that affect the comfort and happiness of the residents and the value of their property.

Port Authority Elects Officers

Eugenius H. Outerbridge has been re-elected chairman of the Port of New York Authority; DeWitt Van Buskirk as vice-chairman succeeds J. Spencer Smith, whose term as a commissioner expired on July 1. Julian A. Gregory has been appointed a commissioner, vice Mr. Smith. William Leary has been re-elected secretary, Julius H. Cohen, counsel and Gen. Geo. W. Goethals, consulting engineer.

No Justification For Davis Dismissal Revealed

All Evidence Still Shows Reclamation Service Reorganization Due to Politics

Washington Correspondence

Nothing to justify the abrupt dismissal of A. P. Davis from his position as director of the Reclamation Service has developed since the Secretary of the Interior took that action. Such justification as has been proffered on his Alaskan trip by Secretary Work and by his assistants at Washington seems to have been refuted as the facts became available.

One of the reasons put forward for the summary character of Mr. Davis' dismissal was that the situation of the water users is so desperate as to make necessary drastic action. That the farmers on the reclamation projects are in any such plight as that described at Secretary Work's office, seems to be contradicted by the Secretary of Agriculture who is authority for the statement that "the financial distress among farmers on these projects is no greater than the financial distress of farmers not on reclamation projects throughout the region from the Missouri River west. In that region there are large sections in which I have no doubt agricultural distress is greater than on the reclamation projects."

As the situation is being analyzed more thoroughly, those who are looking into the matter are more convinced than ever that the motive behind the change was an endeavor to secure a partisan political advantage. During the entire time Arthur P. Davis was at the head of the Reclamation Service, he did all in his power to prevent attempts to dilute the reclamation fund. He feels that there are too many projects as it is, and that successes must be made of those before attempting to take on more. This policy aroused bitter complaint from those who are anxious to have Uncle Sam undertake further development. There is reason to believe that no small part of the influence which resulted in the ousting of Mr. Davis came from those who are anxious to interest the federal government in the Columbia Basin project. To this, however, must be added the influence of those who wanted to see Mr. Davis removed from the path along which their various schemes must advance, to say nothing of those concerned with existing projects who would repudiate obligations.

Action Doubtless Hasty

Whenever a new secretary takes over the direction of the Interior Department, he is at once the target for hundreds of letters from those who are disgruntled and from those who want to depart from established policy. While these protests probably represent the opinion of only one-tenth of one per cent of those concerned, they do make an impressive pile when they converge on the desk of a new secretary.

Being inexperienced in the handling of large affairs and being a man with an explosive disposition, Secretary Work is thought to have rushed to a decision in regard to the conduct of the Reclamation Service, without consulting the very capable men in his department who are in a position to counsel him wisely.

There is reason to believe that Secretary Work brought up at a cabinet meeting the need for changes in reclamation policy. The cabinet is thought to have agreed that something should be done, but the clumsy way in which the idea was carried out is not likely to meet with approval of the President or any of Dr. Work's ministerial associates.

Despite the fact that Mr. Davis was active in the effort to secure the transfer of river and harbor work from the Corps of Engineers, the consensus of opinion in that organization appears to be strongly condemnatory of political interference with the conduct of a technical bureau and of the sweeping indictment of the engineering profession in Secretary Work's announcement that the Reclamation Service should be in charge of a business man and not an engineer. Engineer officers point out, however, that this incident constitutes striking proof why river and harbor work should be left in their department. Since the army engineer can not be discharged, he is in a position to be entirely independent of political influence by the proponents of some project which he did not approve.

All Acquitted of Conspiracy in Phillipsburg Sewage Case

All of the defendants in the charges for conspiracy to defraud the town of Phillipsburg, N. J., of some $23,000 of extras for the construction of sewage-works were acquitted by the trial jury of Warren County on July 26. The grand jury indictments were brought against the Municipal Disposal Co. (now the Direct Oxidation Disposal Corporation) of Philadelphia, contractors for the work, H. Jerome Hirst, president and Charles E. Parry, engineer, of the company; C. E. Tilton, town engineer of Phillipsburg while the work was under construction; and Edward and Francis Korp of the Korp & Korp Construction Co., of Phillipsburgh, the last-named company being the subcontractor for part of the sewage-works.

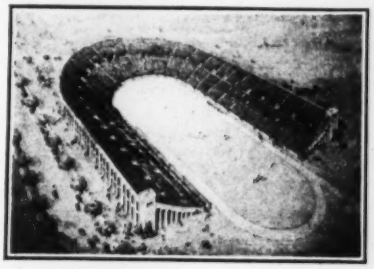
The contract price for the entire plant was $147,980, of which $122,000 was for the machinery and equipment and $25,980 for other material and labor. The Municipal Disposal Co. subcontracted with Korp & Korp for all the work outside the plant and machinery, the contract agreement being for cost plus 15 per cent. Mr. Tilton, as town engineer, certified to extras on the subcontract work totaling $26,556 and his certification was approved by the town commissioners. The Grand Jury held that the greater part of the extras allowed should have been included in the contract price, but to this the trial jury did not agree.

The town commissioners were not indicted but four of the five commissioners (the fifth was not in office at the time the certificates were approved) were censured by the Grand Jury for disregard of state laws in letting contracts and in authorizing contract payment, and for various other sins of omission and commission — some of which, however, had nothing to do with the sewage-works contract.

Mr. Tilton is still under indictment for malfeasance in office. Further particulars regarding the original indictments may be found in *Engineering News-Record*, April 22, 1922, p. 710.

Contract Let on Indiana Stadium

Contract has been let for about half the reinforced-concrete stadium which will be built soon by the University of Indiana. The structure is of reinforced concrete with an ultimate seating capacity of about 50,000, though the contract recently let covers only about half the depth of the structure shown herewith or at the line indicated by the middle aisle running entirely around the stadium. This construction will be twenty-eight rows of bench seats with two rows of box chairs in front having a capacity of about 22,000. Considerable grading will be necessary in the construction inasmuch as there is no level piece of ground anywhere on the campus sufficiently large for an athletic field. The Osborn Engineering Co. who designed the structure was able to select a location in a hollow where advantage could be taken of the grading and the larger portion of seats constructed on ground either excavated or filled. A contract was awarded to the Bedford Steel Construction Co., Bedford, Ind., at a price slightly over $4 per seat for the structure itself which does not include grading, plumbing, heating, lighting, drainage and incidentals. The price per seat excluding only grading will be about $6.



Rapid Progress Made on the Oak Grove Power Project in Oregon

Rapid progress is being made on the Oak Grove project on the Clackamas River in Oregon where the Portland Railway, Light & Power Co. will develop 35,000 hp. in a single reaction turbine under a head of 850 ft. With a total of 1,700 men in the camps work has been carried on simultaneously on the several parts of the project.

The railroad has just been completed for its full length of 23½ miles, using a maximum of 6 per cent grades and 40-deg. curves. Five geared locomotives are in service. The region is heavily timbered and it has been worth while to log off all areas that had to be cleared. On the transmission line particularly this has been an important item.

Work is under way on the 65-ft. diversion dam; grading has been completed for about 70 per cent of the 32,900-ft. pipe line that will consist, for the most part, of 9-ft. steel pipe, and about 4,400 ft. of this pipe has been placed. Work is well under way on the five short tunnels and loose material has been sluiced from the penstock and power house sites. The plant is to be finished and in service by the middle of next year.

H. A. Rands is in charge of design and construction for the power company; the Hurley-Mason Co. of Portland are the principal contractors.

Random Lines

"The Frogs"

By Our Federal Aristophanes

We reprint below, without comment, an authentic bit of interdepartmental correspondence:

TREASURY DEPARTMENT
INTERNAL REVENUE SERVICE
Louisville, Ky.

June 9, 1923.

To the gentleman to whom
this letter will be referred.

Dear Sir:

Can you inform me how to get rid of a frog chorus that performs every night, and all night long—most of the time, too, all day long, around a pond in a vacant lot next to my home?

They are first-class sleep destroyers and a great nuisance generally to everyone within two hundred yards of them.

The property has been taken over by the State for taxes, which makes any interference thereon red-tapey, more or less annoying and more or less (principally more) a matter of time.

I have gone to quite some expense impregnating the pond to chase the frogs away, but they have absorbed everything so far and come up hollering for more.

Thanking you in advance, I am,

Yours sincerely,
R. O. DEPPEN.

June 14, 1923.

Mr. R. O. Deppen,
4700 S. 4th St.,
Louisville, Ky.

SUBJECT:

The bulldog on the bank and the bullfrog in the pool.

Dear Sir:

1. Your letter of June 9th, in which you ask how to get rid of a frog chorus, is one of the most pathetic that has ever come to this Bureau. Many persons enjoy such choruses and would be glad to be in your shoes, or bed, just for the sake of hearing the nocturnal concerts about which you complain. It is a pity that Nature's music should not be appreciated.

2. Unfortunately, there are persons of an excitable and choleric temperament who instead of being lulled to sleep by the song of the innocent batrachians are greatly enraged by it. Apparently you are in this class, and we venture to make a few suggestions for your relief.

3. Try autosuggestion. Imagine that you are listening to a jazz band performing for your benefit, playing a lullaby or nocturne.

4. Incite a crowd of small boys to capture the larger frogs and turn loose in the pond a number of water snakes to devour those that escape the boys. Perhaps a few lengths of garden hose, suitably painted and set around the banks at intervals, would serve as substitutes for real snakes. They might be called scare-frogs.

5. Your position in the Internal Revenue Service should make it easy for you to acquire plenty of the deadliest hooch. Have you tried impregnating the pond with that? If so, and the frogs came up for more, they are evidently steeped in the ancient traditions of the State and think that you are providing one of the essentials of life. The mint probably grows nearby.

6. There are various ways to deaden sounds, but you are probably not willing to sleep with closed windows in summer or to go to the expense of completely enclosing the pond in sound-proof walls. Besides, the State might shift the burden of paying the taxes to you, if you trespassed to that extent. Maxim silencers might be effective, but they would be burdensome to the frogs. Anyway, it would be easier to kill the frogs when caught than to attach the silencers.

7. These are but amateur suggestions for your relief. Frogs are not within our jurisdiction, but come under the Bureau of Biological Survey. Also, we do not work on drugs and poisons, and cannot recommend soporifics and sedatives for man or beast. Advice about these might come from the Public Health Service, Treasury Department, or from the Bureau of Chemistry, Department of Agriculture. We shall send your letter to the latter Department because it also includes the Biological Survey.

Respectfully,
GEORGE K. BURGESS, Director
U. S. Bureau of Standards.

D-O Process for Trenton Again Disapproved

New Jersey Health Board Rejects Sewage Plans and Directs City to File New Ones Within a Year

Reiterating and expanding portions of its resolution of May 1, in which it refused to approve plans for treating the sewage of Trenton, N. J., by the direct-oxidation or lime-electrolysis process as drawn for the city by Col. George A. Johnson, consulting engineer, the State Board of Health of New Jersey again rejected the plans on July 31. The city was directed to file new plans within a year, these plans to comply with standard and accepted methods of sewage treatment and to contain only such elements as are necessary to comply reasonably with the policy stated in the Delaware River sewage zoning agreement between the New Jersey and Pennsylvania Departments of Health. (For the zoning agreement and for the Trenton sewage-works resolution of May 1, see *Engineering News-Record*, Aug. 10, 1922, p. 243, and May 31, 1922, p. 972.)

In its resolution of May 1, rejecting the plans then before it, the board advised Trenton that in its opinion sedimentation alone would be sufficient treatment for the sewage of that city for ten years and probably longer, or that in lieu thereof fine screening and lime treatment, with use of sludge thickeners, would do. The resolution also gave Trenton a month to reconsider the plans and afforded it a chance to re-submit the rejected plans for consideration by the board as for an experimental process. The Trenton City Commission accepted neither alternative. Instead, it again submitted the old plans for unconditional approval, accompanied by a resolution stating that it considered the direct-oxidation process the best and most satisfactory method of sewage treatment available.

The resolutions adopted by the New Jersey Board of Health on July 31 follow:

Whereas, The Board of Commissioners of the City of Trenton have, at their meeting held on June 8, 1923, adopted a resolution requesting the State Department of Health of New Jersey to approve plans for a sewage disposal works for the purpose of treating the sewage of Trenton and have expressed it as the opinion of said commissioners that the system of direct oxidation provided for in plans submitted to this Department for approval on Dec. 15, 1922, and referred back to the said commissioners by this department on May 1, 1923, for reconsideration, is the best and most practicable method for the City, and

Whereas, The proposed sewage disposal plant for the City of Trenton is to be constructed because of proceedings initiated by this department in the chancery court compelling action by the commissioners of the City of Trenton, and

Whereas, The Department of Health of the State of New Jersey in conjunction with the Department of Health of the State of Pennsylvania, on June 20, 1922, adopted a policy declaring, insofar as the policy affects the City of Trenton, that "Sewage discharged into the tidal portion of the Delaware River, from and including Morrisville and Trenton and to and including Philadelphia and Camden, shall be treated by means of sedimentation and the effluent discharged through submerged outlets into deep water in the Delaware River; . . . provided, that when plans for sewage treatment works are approved, where sedimentation of sewage is the only treatment required under this policy, the approval shall be subject to the condition that means for the further purification of the tank effluent shall be installed when deemed necessary by the State Department of Health.

Whereas, This Department is of the opinion, and so stated in a resolution passed on May 1, 1923, that the direct oxidation method of sewage treatment is still in an experimental stage and has not as yet been demonstrated as a practical and continuous method for the treatment of sewage, and is informed that the system has as yet not been endorsed or accepted by the engineering profession skilled in the treatment and disposal of sewage,

Therefore, Be It Resolved, That the Department of Health of the State of New Jersey does hereby reject the plans for the direct oxidation method as submitted by the City of Trenton and directs said city to file with this department, within one year, plans for a sewage disposal works in accordance with accepted and approved standards and methods for the treatment of sewage and containing only such elements as are necessary to comply reasonably with the terms of the policy adopted by the State Department of Health of Pennsylvania and the State Department of Health of New Jersey on June 30, 1922, above referred to, said new plans to be readily adaptable to providing additional means of purification later on if and when in the opinion of the Department that shall become necessary, provided, however, that the extension of time shall meet the approval of the chancellor.

To Build Vehicular Tunnels at New York City

Gov. Smith of New York has announced that he will recommend to the Port of New York Authority that it proceed at once to issue the necessary bonds to finance the construction of two vehicular tunnels under the Hudson River at New York City. Gov. Smith expects to confer with the Port Authority as to the location of these tunnels. They will be in addition to the one now under construction at Canal St. and will probably be located farther uptown; one will probably be in the neighborhood of 14th St.

To Use Old Canal Plane as Hydraulic Laboratory

The New Jersey Department of Conservation and Development is working upon a plan for the establishment of an hydraulic laboratory at the site of the old inclined plane of the Morris and Essex Canal near Boonton. The contemplated laboratory would be made part of the Rutgers College School of Engineering to be used in conducting tests on all kinds of hydraulic equipment. The site of the old canal plane is an ideal one, as such experiments can be carried out without interfering with the existing water power rights at that point. At the same time it will be possible to preserve the old plane.

Albany Appropriates $600,000 for Filter Plant Improvements

An appropriation of $600,000 has been made by the city authorities of Albany, N. Y., to overhaul the water purification plant and build a 10,000,000-gal. coagulating basin in accordance with recommendations of Allen Hazen, consulting engineer, New York City, in a report to F. A. Raven, commissioner of public works. The slow sand filters built over twenty years ago with Mr. Hazen as engineer are reported by Mr. Hazen as being still in good shape but new sand handling equipment and new orifices and gages are advised, the latter because of an increased rate of filtration. The scrubbers installed some years after the slow sand filters were built are to be repaired and improved; the old sedimentation baffled; some piping and Venturi meters added; the pumping plant changed; and dry-feed apparatus for alum provided at an estimated cost of $29,000. There is an item of $52,000 for wash-water pumps and tanks and $40,000 for a new laboratory building and equipment. Extension of metering is advised as a readily possible means of still further reducing the per capita consumption so the original slow sand filters, operating at an increased rate due to the preliminary treatment—coagulation, sedimentation and rough filtration—may suffice for years to come. Possible new sources of supply, with particular references to gravity supplies, are reviewed but no specific action to this end is advised.

Civil Service Examinations

UNITED STATES

For the U. S. Civil Service examinations listed below, apply to the United States Civil Service Commission, Washington, D. C., or to any local office of the Civil Service Commission.

Hydrographic and topographic draftsman — Vacancies in the Coast and Geodetic Survey, at an entrance salary of $1,400 a year plus the increase of $20 a month allowed by Congress, and vacancies in positions requiring similar qualifications.

Hydrographer—Vacancy in the Reclamation Service at El Paso, Tex., and Powell, Wyo., at salaries ranging from $1,680 to $1,920 a year, plus the increase of $20 a month allowed by Congress, and vacancies in positions requiring similar qualifications.

Applications for both must be filed with the Civil Service Commission, Washington, D. C., by or before Sept. 11, 1923.

Tunnel Contractor's Claim for Extras Denied by Higher Court

Reversing a decision rendered by the federal district court a year ago, the U. S. Circuit Court at Boston last week denied the claim of Patrick McGovern for extra compensation because of encountering a ledge of rock in digging the Dorchester tunnel. The case has been in the courts for five years. It was dismissed by the Massachusetts Supreme Court in 1918, and later was carried into the federal courts. A master appointed by the district court found in favor of McGovern, awarding him $135,000 compensation, and this award was confirmed by the court. On the city's appeal to the circuit court this decision has now been reversed.

Engineering Societies

Calendar

Annual Meetings

NEW ENGLAND WATER WORKS ASSOCIATION, Boston, Mass.; Annual Convention, Burlington, Vt., Sept. 18-21, 1923.

INTERNATIONAL ASSOCIATION OF STREET SANITATION OFFICIALS, Chicago, Ill.; Annual Conference, Chicago, Sept. 27-28, 1923.

AMERICAN PUBLIC HEALTH ASSOCIATION, New York; Annual Meeting, Boston, Oct. 8-11.

AMERICAN SOCIETY OF CIVIL ENGINEERS, New York; Fall Meeting, Richmond, Va., Oct. 15-17.

AMERICAN SOCIETY FOR MUNICIPAL IMPROVEMENTS, St. Petersburg, Fla.; Annual Convention, Atlanta, Ga.; Nov. 12 to 16.

Personal Notes

F. H. COTHRAN, formerly resident manager of the Quebec Development Co. and the Alma & Jonquiere R.R., is now vice-president of these companies at St. Joseph d'Alma, Province of Quebec. The Quebec Development Co. is building a 480,000-hp. hydroelectric development on the Saguenay River.

V. A. KAUFMAN has been appointed assistant chief engineer on the Moffat Tunnel Work. He is the man who had charge of the original survey for the commissioners and supervised the drawing up of the plans and specifications. Mr. Kaufman is a civil engineer graduate of Ohio Normal University. He has had charge of various railway rock and tunnel projects in the West, and was for some time construction engineer for the Rio Grande, Sierra Madre & Pacific R.R. in Chihuahua, Mexico.

ROBERT HOFFMAN, city engineer of Cleveland, was tendered a banquet at Wade Park Manor recently by the members of his organization in honor of the completion of thirty years' service as the head of his department. The principal speaker of the evening was former Secretary of War Newton D. Baker.

A. W. ZESIGER, formerly bridge engineer for Cuyahoga County, has recently been appointed by State Highway Director L. A. Boulay as chief engineer of bridges. Mr. Zesiger assumed his new duties in Columbus Aug. 1..

CARL J. SITTINGER, for the past four years associated with John A. Stevens, consulting engineer, of Lowell, Mass., is now engineer in the Electrical Division of Stone & Webster, Inc., of Boston, Mass.

JOHN B. BRAY, commissioner of public works, Raleigh, N. C., has been appointed city manager of Elizabeth City, N. C. C. C. PAGE has been elected commissioner of public works succeeding Mr. Bray.

GROSVENOR W. STICKNEY has been appointed city engineer of Wheaton, Ill., to succeed L. W. Ruddock, resigned. Mr. Stickney has been for some time assistant engineer with A. L. Webster, municipal and drainage engineer, of Wheaton.

FRANK C. SQUIRE, Portland, Ore., has been appointed engineer of the Western Group, President's Conference Committee, Federal Valuation of the Railroads in the United States, effective Aug. 1. Mr. Squire is at present valuation engineer of the Oregon-Washington R.R. & Navigation Co. at Portland.

PROF. HAROLD A. THOMAS, for eight years associate professor of civil engineering and for the past five years professor of hydraulics at Rose Polytechnic Institute, Terre Haute, Ind., has been appointed professor of theoretical hydraulics and of hydraulic and sanitary engineering at Carnegie Institute of Technology, Pittsburgh, Pa. Prof. Thomas obtained his C. E. degree from Columbia University in 1908. In his professional work he has served as a member of the engineering corps of the New York State Water Supply Commission, member of the engineering corps of the Great Northern R.R., assistant engineer for the Miami Conservancy District on flood-control work, and as consulting and practising civil and hydraulic engineer at Terre Haute, Ind. He is a pioneer in concrete research work.

J. H. GANDOLFO, who joined the engineering department of the Power Corp. of New York and the Northern New York Utilities, Inc., of Watertown, N. Y., in 1922 has been appointed chief designing engineer of these organizations. Mr. Gandolfo was formerly with the Hudson & Manhattan R.R. Co., J. G. White Engineering Corp., Westinghouse, Church, Kerr & Co., and the Division of Architecture and Construction, State of N. J., and has had charge of the design and construction of many important structures in the United States and its possessions.

FRED R. WHITE, state highway engineer of Iowa, is now actively engaged in directing the affairs of the American Association of State Highway Officials. With the resignation of Charles J. Bennett, the State Highway Commissioner of Connecticut, Mr. White automatically succeeded in the presidency of the organization.

Obituary

JOHN P. LEO, who was street cleaning commissioner of New York City from January to November, 1921, died July 23 of heart disease at Pawling, N. Y., where he was visiting. Previous to 1921 Mr. Leo had served on the New York snow removal committee which handled the exceptionally heavy snowfall of 1921, and as chairman of the Board of Standards and Appeal.

EDWIN E. BAKER, of Greeley, Colo., one of the state's oldest engineers, died recently at the age of 78 years. Mr. Baker built the Riverside reservoir near Sterling, Colo., the Tarry Lake reservoir near Fort Collins, the Fort Morgan canal, and the Platte and Beaver canals near Brush, Colo. He was a native of Fort Wayne, Ind., and a soldier in the Civil War.

From the Manufacturer's Point of View

A Point of Contact Between Maker and User of Construction Equipment and Materials

Manufacturers Adopt Standard Size for Common Brick

Through the co-operation of the Division of Simplified Practice of the Department of Commerce the common brick industry has discarded a great variety of odd sizes of brick and established one standard size for the seven billion building brick produced every year in the United States. This size is approximately 8 x 3¾ x 2¼ in. The only exception now to be allowed is in the case of smooth-faced brick for special exterior use, in which a slight variation in one dimension only is permissible.

The common brick industry established the standard size some years ago, but experienced trouble because its standard was not insisted upon for public work and by many architects. With the Government now definitely supporting the industry in its efforts to standardize its product it is expected that before long all specifications will call for standard sized brick, to the great benefit not only of the brick industry but to all users of its product.

New Plant for Meter Company in Five-Story Building

On a 2½-acre plot of ground in the Brushton district of Pittsburgh, a five-story building is nearing completion which will contain the new offices and works of the Pittsburgh Meter Co., manufacturer of water and gas meters. Founded in the '80's, the company was first known as the Safety Appliance Co., later as the Fuel Gas & Electric Co.; since 1895 it has operated under its present name. The early types of gas meter manufactured by the company were the invention of George Westinghouse. The building which will house the new plant is 80x300 ft. In plan, five stories high and will provide a floor space of approximately 150,000 sq. ft. The building is served by a private siding from the Pennsylvania R.R.

Heavy Duty Truck Sales Increase

All sales records for the first six months of any year in the history of the General Motors Truck Co., Pontiac, Mich., were broken during 1923, according to a tabulation just completed. During the first six months of the present year, this company sold 171 per cent more trucks than during the same period of 1922; the figures show that the so-called heavy-duty models have grown in popularity during the last year.

During the first half of this year the company sold 284 per cent more heavy-duty trucks than during the corresponding period of a year ago. While national figures show that the 1-ton truck is by far the most popular model made by truck manufacturers, this company asserts that the heavy duty units are fast overhauling the 1-ton models.

Tests of Interlocks Point Way to Safer Elevators

About three-fourths of all fatal elevator accidents are found to occur at the hoistway door, either because of the door being opened when the elevator is not there or because of the elevator starting when the door is open. These accidents, according to the U. S. Bureau of Standards, can be prevented by a reliable interlock, as when such a device is used the elevator must be stopped at the floor before the door can be opened, and the door must be closed before the car can be started again.

During the past year the Bureau has been conducting tests to determine the reliability of the various types now on the market. The devices have been given endurance tests under normal conditions, they have been tested in a corrosive atmosphere, in a dust-laden atmosphere, without lubrication, and under conditions of misalignment likely to occur in practice. The tests were conducted at the request of the City of Baltimore, and will permit city governments to base their approval of such devices on actual performance tests instead of on visual inspection alone. The results have also been made available to the manufacturers of the devices tested, and in most cases they have improved their designs in accordance with the suggestions offered.

Chart Shows Trucks Needed With Mechanical and Hand Loading

By W. H. Bosworth
Field Sales Engineer, The Geo. Haiss Manufacturing Co., Inc., New York

THE accompanying diagram shows the number of trucks required to haul a given daily yardage of material —sand, gravel, crushed stone, cinders or earth—for distances of ½ to 10 miles, with hand loading and mechanical loading of trucks. Approximate average conditions are assumed: 9-hour day; 5-yd. trucks; loaded speed, 8 miles an hour; empty speed, 12 miles an hour; allowance for dumping, 1 min.; time of hand loading for sand, 17 min.; time of hand loading for stone, 25 min.; time of loading with truck loader, 4 min.

To illustrate the use of the diagram assume the case of a contractor who must deliver 300 cu.yd. of crushed stone daily with a haul (one-way) of 3 miles. How many 5-yd. motor trucks will he need if the loading is (1) by hand: (2) by mechanical loader?

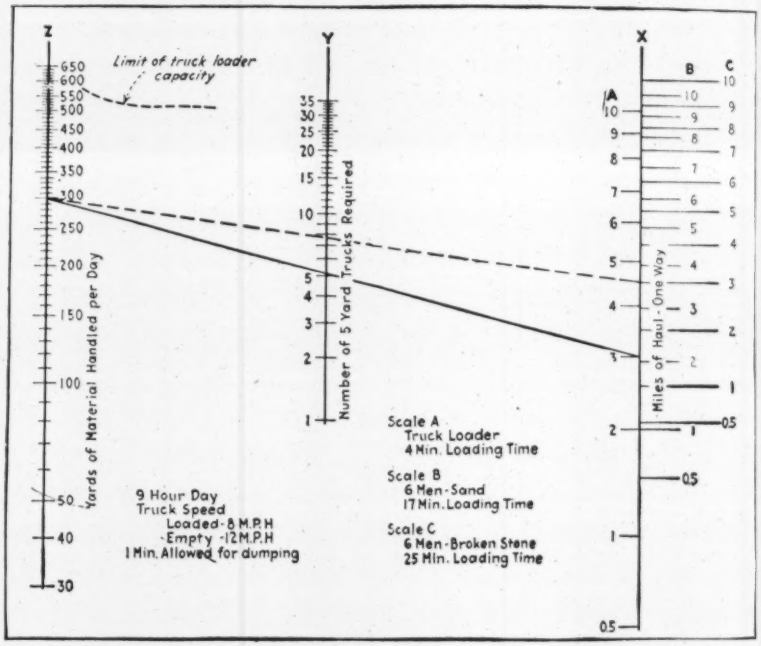


DIAGRAM FOR DETERMINING NUMBER OF TRUCKS NEEDED WITH MECHANICAL AND HAND LOADING

A line drawn between the yardage to be moved per day on "Z," and the length of haul on "X," to the proper scale, A, B, or C cuts "Y" at the number of 5-yd. trucks required. Similarly, a line from the haul on "X" through the trucks available on "Y" will meet "Z" at the yardage which can be moved with that combination of equipment.

For hand loading: On left-hand scale, (Z) select point at 300 (yd. of material to be handled daily) and on right-hand scale (X-C, for broken stone) select point at 3 (miles of haul, one-way). Join the two points with straight line and at intersection of this line with middle scale (Y) read "8" trucks.

For mechanical loading: Repeat process, except use right-hand scale (X-A) instead of scale (X-C). The trucks needed in this case are shown to be "5", or a saving of 3 trucks with mechanical loader.

The rates of hand loading are for 6 men per truck and are about twice the daily average. The men will load

half the time and rest the other half. The rate of mechanical loading assumed will be equalled or excelled by any high-powered truck loader, mounted on caterpillars and with self-feeding device and crowding speed, in any loose material. Scale A, for the truck loaders, is also applicable to any other mechanical means of loading of the same approximate capacity, such as power-shovels, crane and clamshell bucket, etc.

The diagram is only true for the conditions assumed, but they are reasonable. It shows forcibly one reason why machinery is used so largely for loading which has not been stressed so much as the obvious one of saving in cost of actual loading, and that is the greater efficiency of the trucks. When 500 yd. of stone are to be moved each day, mechanical loading saves 5 trucks, each of which costs more to operate than the loading machine. As a matter of fact the money saved in this way is usually greater than the saving in cost of actual loading.

The answer for other conditions than those assumed can of course be approximated from the diagram. The number of trucks required will vary approximately inversely as their capacity. If the speed at which the trucks travel is not as assumed, the number required will vary approximately directly as the total round-trip time, including loading. Different loading rates can be interpolated approximately on the line X.

Report on Bethlehem Plan of Employee Representation

President Eugene G. Grace, of the Bethlehem Steel Co., made public July 27 the first report on the results of the plan of employee representation which has been in effect at the plants of the company since 1917. Of the 2,365 cases which actually reached the employees' representatives in committee and in some instances reached joint committees as well, 1,682, or 71 per cent, were settled in favor of the employees. In the Bethlehem plan elected employee representatives operating by themselves, with negotiating powers through committees of their own choosing, and also in appeals through joint committees with appointed management representatives, pass upon every matter arising out of the employment relationship which has not been satisfactorily settled in the first instance with the ordinary plant authorities for individuals or for groups.

Three hundred and thirty cases raised by employees, or 14 per cent of the total, were settled in the negative, most of them in the first stage by the employee representatives' own committee, without the complainer availing himself of the appeal provisions of the plan. Over 201 cases, or 8.5 per cent, were withdrawn by the employees concerned after the facts were brought out. Over 103, or 4 per cent, were compromised, and only 49 were pending settlement in four large plants using the plan.

Since the inauguration of the plan in 1917, 2,365 cases have been adjusted; 612 of these cases, or more than one-fourth were directly concerned with employment and working conditions; 570 other cases which came up for adjudication dealt with wages, piecework, bonus and tonnage scheduled.

Simplified Asphalt Grades Win Endorsement

Substantial progress has been made in securing endorsement by both asphalt producers and consumers of the simplified scale of 10 grades (as determined by penetration limits) adopted at the joint conference with the Division of Simplified Practice of the Department of Commerce held in Washington, D. C., May 28.

"Engineering News-Record" has received from the Department of Commerce the following report on the status of the movement for fewer grades:

"To date (July 30, 1923), we have received acceptances to the asphalt simplification from the Asphalt Association, which speaks for its entire membership, the American Society for Testing Materials, and 15 out of 48 state highway engineers. This indicates that the project is going smoothly and we are in hopes of getting the remainder of acceptances from the engineers within the next two weeks."

Committee Names Three Sizes for Tilting Mixers

The Joint Committee on Construction Equipment, at a meeting held in Chicago this week, recommended for adoption as standards three sizes—3½, 5 and 7 cu.ft.—of concrete mixers of the tilting type.

The committee, at its previous meeting, June 27-29, considered only the non-tilting type of mixer, recommending four sizes of building mixer—7, 14, 21 and 28 cu.ft.—and three sizes of paving mixer—7, 12 and 21 cu.ft., as reported in *Engineering News-Record* of July 5, p. 36 and July 19, p. 120.

Business Notes

WESTERN WHEELED SCRAPER CO., Aurora, Ill., announces that W. G. Sharretts has been transferred from the Atlanta territory to take charge of the New York Office. He will have charge of the company's domestic sales in the Eastern territory with contractors as well as industrial and railroad companies, selling arrangements heretofore existing in New York having been cancelled.

GINSBERG-PENN CO., INC., New York, sales representatives for construction machinery, has been appointed, effective Aug. 1, to take on exclusive distribution of the line of locomotive auto and Truckranes manufactured by the Byers Machine Co., Ravenna, Ohio. Frank I. Ginsberg, president of the distributing company, was formerly with the R. E. Brooks Co. and the Insley Manufacturing Co., Hamilton, O. Penn served with the T. L. Smith Co.

VULCAN IRON WORKS, Wilkes-Barre, Pa., announces the appointment of Thomas MacLachlan as manager of its New York office, succeeding M. E. Davis. The company manufactures locomotives, electric hoists, steel castings, cement mills, coolers and dryers.

CLERMONT CLAY PRODUCTS CO., Philadelphia, has been organized to take over the plant and property of the International Clay Products Co., manufacturing underground conduits at Clermont, Pa.

A. S. MOODY, assistant Northwest manager of the General Electric Co., Schenectady, N. Y., has been appointed local manager of the Los Angeles office of the same company, to succeed R. L. Cash, who has been transferred to Schenectady. Mr. Moody has been identified with the General Electric Company on the Pacific Coast section for the past 16 years.

Equipment and Materials

Safety Clamp for Wire Rope

For fastening wire rope a clamp with a U-bolt and self-tightening cam which it is claimed cannot slip or crush the cable, is being manufactured by the Mal-Gra Casting Co., Cambridge City, Ind., under the trade name of the Keator safety clamp. The clamp, as shown in the accompanying illustration, is applied square with the cable and tightened with a wrench. A feature of the device is the use of a grooved cam which serves the double purpose

of protecting the cable from the concentrated pressure of the U-bolt and of providing an eccentric movement which causes it to increase its grip as the cable turns it under pressure. Only one clamp of the Keator type is said to be required for each cable. The self-tightening feature it is pointed out automatically compensates for the shrinkage of the cable under load, and merely grips the tighter as the load increases.

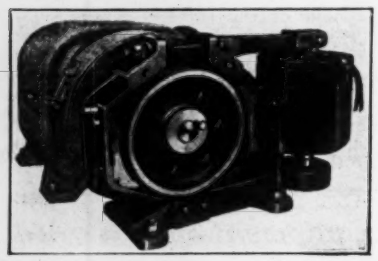
New 1¼-Yd. Heavy-Duty Shovel

To its line of revolving steam shovels, the Osgood Co., Marion, O., has added a new 1¼ yd. heavy-duty model of the full revolving type, mounted on crawler treads. The shovel, designed for heavy work, has over-sized castings and large bearing surfaces at points of great stress. The boom and dipper handles are built up of white oak timber shrouded with plate steel and the whole securely bolted to form solid units. Double gearing on the dipper shaft insures equal application of power to the dipper handle racks, eliminating side strain and twisting. The continuous tread mounting has an all-gear drive. In general design, the machine is patterned after the Osgood ¾-yd. shovel.

Quick-Acting Solenoid Brake for Crane Service

A quick-acting, powerful solenoid brake has been designed especially for crane service by the Whiting Corp., Harvey, Ill. The brake arms are so pivoted that the shoes release equally at all points, preventing dragging. The shoes are cast iron filled with a durable and heat-resisting asbestos composition. To take out the shoes it is only necessary to remove four cap screws and pry the shoe out. Under ordinary conditions, the manufacturer states, adjustment is required only once a month.

The brake is made in both direct-current and alternating-current models. On



the former, the plunger is of soft iron of large diameter, giving a fast operating solenoid even at light loads. The d.c. coils are designed to operate the brake at about 40 per cent full load current and remain open at 10 per cent or less full load current. The voltage lost in the coil in most averages less than 4 per cent, and in no case more than 7 per cent. On the alternating-current type, the plunger is of laminated iron of proper thickness for the service intended.

For test purposes a 12-in. brake was mounted on a 25-hp., 550-r.p.m., direct-current motor. The motor was stopped 50,000 times at a rate of 325 stops per hour without resulting in excessive wear of the brake shoes.

Publications from the Construction Industry

Rolling Steel Doors—J. G. WILSON CORP., New York, in a 72-p. illustrated catalog explains the design and operation of its rolling steel doors and illustrates the variety of their use in industrial and commercial buildings. The standard doors are made of slats of open-hearth or copper-bearing steel which are raised or lowered by winding on a shaft operated either by hand or electric motor. Among typical installations shown in about 30 pp. of photographs are warehouses, car barns, railway shops, power stations, freight stations, docks factories and airplan hangars.

Waterproofing — GARDINER & LEWIS, INC., New York, has published a 32-p. pamphlet, illustrated, dealing with the principles underlying the manufacture, use and specifications for bituminous materials employed for waterproofing. A number of specific waterproofing problems are presented, with drawings, in which the use of the company's Karnak membrane water-proofing is employed in buildings, swimming pools, reservoirs and dams, and steel and concrete bridges.

Business Side of Construction

FACTS AND EVENTS THAT AFFECT COST AND VOLUME

N. Y. Builders Increase Support for Apprenticeship Work

An appropriation of $25,000 has been made by the New York Building Trades Employers' Association to the New York Building Congress for the work of the Apprenticeship Commission during the ensuing year. This represents a material increase over last year's appropriation of $8,000 by the same body for this purpose.

It is anticipated that the local labor organizations also will again contribute to the work of the commission as they did last year.

This enterprise is a joint undertaking of the building trades employers, building trades labor and the city educational authorities to provide a systematic training for apprentices in the several building trades. Its work was described and discussed at greater length in *Engineering News-Record* of Jan. 11, 1923, p. 62 and April 19, 1923, p. 695.

Lumber Movement Gains

The nation's lumber business for the week ending July 21 showed an appreciable gain over the preceding week, according to the weekly review of the National Lumber Manufacturers Association. With only 408 of the larger commercial mills of the country represented, as compared with a revised total for 423 for the preceding week, new business, shipments and production showed gains. As compared with last year the week also showed advances in all three factors. The 137 Southern pine mills gave their unfilled orders as 250,985,085 ft. as compared with 252,785,610 ft. the preceding week and 128 West Coast fir mills gave their unfilled orders as 306,985,928 ft., as against 349,761,933 ft. the week before, the net decline in unfilled orders for both groups taken together being 44,576,530 ft.

For all the reporting mills shipments were 87 per cent and orders 78 per cent of actual production. For the Southern pine mills these percentages are respectively 90 and 87 and for the West Coast mills 100 and 90. Most of the mills have an established normal production figure for the week, in relation to which actual production was 107, shipments 95 and orders 86 per cent.

The following table gives the lumber movement for the week ending July 21, the corresponding week of 1922 and the preceding week of 1923 for purposes of comparison:

	Week Ending July 21	Corresponding Week 1922	Preceding Week 1923 (Revised)
Mills	408	368	423
Production, ft.	273,971,556	224,534,859	263,569,278
Shipments, ft.	238,532,807	214,745,867	231,313,698
Orders, ft.	214,822,645	206,982,446	208,265,237

The following table compares the reported lumber movement for the first 29 weeks of 1923 and for the same period in 1922:

	Production, Ft.	Shipments, Ft.	Orders, Ft.
1923	7,102,633,635	7,331,430,859	7,220,550,231
1922	5,901,915,595	5,997,527,955	6,357,825,589
1923 Increase	1,200,718,040	1,333,902,904	862,724,642

Million Mark Again Passed in Freight Car Loadings

Loading of revenue freight for the week which ended on July 14, according to the Car Service Division of the American Railway Association, totaled 1,019,667 cars. This total fell short 2,103 cars of equalling that for the week of June 30 this year, when 1,021,770 cars were loaded, the greatest number for any one week in the history of the railroads, but this was the second time within three weeks that the previous record, which was made during the week of Oct. 14, 1920 at which time 1,018,539 cars were loaded, has been eclipsed.

Including the week of July 14, the million-car loading mark has been exceeded in six out of eight consecutive weeks so far this year, the average loading for the six weeks being 1,013,118 cars. In 1920, the million-mark was reached only on five occasions and then only in the fall of the year. The average for those five weeks was 1,009,688 cars. The million mark was reached in only two weeks in 1922, but never attained in 1921 or in any week prior to 1920.

From Jan. 1 this year to July 14, inclusive, 25,887,240 cars were loaded with revenue freight. This was an increase of 4,309,272 cars or 20 per cent over the corresponding period last year, and an increase of 5,785,900 cars or 28.8 per cent over the corresponding period in 1921. It also was an increase of 2,676,475 cars or 11.5 per cent over the corresponding period in 1920. In making comparisons with last year, however, consideration must be given to the fact that coal shipments were curtailed by the miners' strike which began on April 1, while on July 1 a strike of railway shopmen also went into effect, both continuing until early fall.

Malleable Castings

The Department of Commerce announces statistics on the production of malleable castings manufactured for sale during June, 1923, as shown by reports received by the Bureau of the Census. The figures for May are revised to include reports received since the preliminary bulletin for that month was issued. The returns include only those castings manufactured for sale as such and do not include those used in the plant or finished and sold as other products.

The returns for June include 96 establishments and show that during the month these plants were operated 67.3 per cent of their total capacity. The revised figures for May include the production of 90 establishments which were operated 71 per cent of their total capacity during the month.

Month	Plants Reporting (Number)	Total Production (Tons)	Total Shipments (Tons)	Orders Booked (Tons)	Monthly Capacity of Plants (Tons)
June	96	61,949	61,441	38,536	92,004
May	90	64,726	62,806	52,898	91,174

July Contracts Over Thirty-Six Per Cent Heavier Than for Corresponding Period in 1922

Falling Off of Thirteen Per Cent Compared With June Awards—Gains in Bridges, Excavations, Streets and Roads

The total value of contracts awarded on large engineering construction projects during July, totaled $163,459,000 as against $188,786,000 for the preceding month. This represents a drop in actual money value of over 13 per cent in one month. Compared with July of last year, however, a gain is noted of somewhat over 36 per cent.

The number of awards totaled 755 during July, with an average value of $216,502 as compared with 816 in June, averaging $231,355.

Minimum costs observed in Construction News on each class of construction are as follows: Water-works, $15,000; other public works, $25,000; industrial construction, $40,000; and commercial buildings, $150,000.

Of the $163,459,000, a total of $8,436,000 represented Canadian awards, which fell off 20 per cent during July.

All classes of construction fell off during July except bridges, excavations and streets and roads. July bridge contracts nearly doubled those of June in total money value, although no single project reached above $780,000. Excavation, drainage and irrigation lettings gained heavily. Increases in these classifications were induced by several large jobs such as the four track subway at Rochester, N. Y., valued at $1,654,765 and a portion of two tunnels, approaches to river section of Hudson River Tunnel, $3,467,414. Streets and roads awards gained over 10 per cent during the month.

Bids Wanted on Big Jobs

Among the projects on which bids are either asked or will soon be called for, in Construction News, pp. 61 to 73, are the following:

Temple, Louisville, Ky., for Kosairs Association, $1,600,000.

Foundation, Minneapolis, Minn., for H. S. Goldie, agent, bids on superstructure at later date, total cost $1,300,000.

Railway, Manitoba, Canada, from Beaconia to Ft. Alexander, for Manitoba Pulp and Paper Co., Ltd., $3,000,000.

Large Contracts Let During Week

Among the week's announcements of contracts awarded in Construction News, pp. 61 to 73, are the following: following:

Medical Association building, Seattle, Wash., to Great Northern Construction Co., $1,800,000.

Subway, Philadelphia, Pa., to Keystone Construction Co., $1,198,555.

Engineering News-Record Construction Cost Index Number

August, 1923	221.50
July, 1923	222.10
August, 1922	173.40
Peak, June, 1920	273.80
1913	100.00

Engineering News-Record's Construction Cost Index Number declined 0.6 points since last month due to drop in lumber. Prices of other basic materials remained unchanged during month. The average rate for common labor is still 54c. Thus, general construction cost is 28 per cent higher than one year ago and 19 per cent under the peak; it is 121 per cent above the 1913 level.

Engineering News-Record Construction Volume Index Number

Monthly	
July, 1923 *(4 issues of E. N.-R.)*	128
June, 1923 *(4 issues of E. N.-R.)*	148
July, 1922 *(4 issues of E. N.-R.)*	118
1913	100
Yearly	
1922 (entire year)	130
1921 (entire year)	88
1920 (entire year)	91
1913	100

Engineering News-Record's Construction Volume Index Number is 128 for the month of July, and 130 for the whole of 1922, as against 100 for 1913. This means that the actual volume of construction in 1922 (not the mere money-value of the contracts let that year) is 30 per cent above the volume of construction for 1913. Our monthly volume number, 128 for July, 1923, is really the increment of construction, and indicates the rate at which contracts are being let as compared with 1913 awards.

VALUE OF CONTRACTS LET IN THE UNITED STATES AND CANADA DURING JULY, 1923

	New England	Middle Atlantic	Southern	Middle West	West of Mississippi	Western	Total United States	Canada	Total
Waterworks	.....	$612,000	$195,000	$1,925,000	$867,000	$59,000	$3,658,000	$145,000	$3,803,000
Sewers	.....	884,000	194,000	706,000	939,000	196,000	2,919,000	264,000	3,183,000
Bridges	$780,000	526,000	800,000	702,000	803,000	330,000	3,941,000	500,000	4,441,000
Excavation, drainage and irrigation	.....	5,146,000	828,000	36,000	570,000	22,000	6,602,000	300,000	6,902,000
Streets and roads	1,435,000	8,649,000	6,268,000	11,691,000	8,148,000	4,495,000	40,686,000	1,711,000	42,397,000
Industrial works	1,308,000	3,215,000	1,936,000	5,105,000	3,090,000	609,000	15,263,000	140,000	15,403,000
Buildings	5,177,000	9,708,000	7,683,000	20,943,000	8,314,000	10,909,000	62,734,000	1,791,000	64,525,000
Federal Government	197,000	638,000	1,251,000	420,000	1,166,000	179,000	3,851,000	.....	3,851,000
Miscellaneous	.....	5,255,000	4,910,000	516,000	1,769,000	2,919,000	15,369,000	3,585,000	18,954,000
July, 1923	$8,897,000	$34,633,000	$24,065,000	$42,044,000	$25,666,000	$19,718,000	$155,023,000	$8,436,000	$163,459,000
June, 1923	10,193,000	43,357,000	15,373,000	58,783,000	29,945,000	20,936,000	178,587,000	10,199,000	188,786,000
May, 1923	16,059,000	50,418,000	23,813,000	45,360,000	25,589,000	30,793,000	192,032,000	26,680,000	218,712,000
Total 3 months	$35,149,000	$128,408,000	$63,251,000	$146,187,000	$81,200,000	$71,447,000	$525,642,000	$45,315,000	$570,957,000

Labor Rates and Conditions Throughout the Country

Industrial operations, generally are proceeding at a rate somewhat over 80 per cent of capacity. The slowing down process now in effect in certain industries is purely seasonal, while in others the reserve materials stocks have apparently reached a point adequate to current trade requirements.

According to latest reports of the United States Department of Labor, employment shows decreases in the following basic industries: paper and printing; vehicles for land transportation; stone, clay and glass products; textiles; iron, steel and other metals.

Increases, however, were noted in the following: leather; lumber; beverages; food; railroad repair shops; tobacco and chemicals.

Wages paid common laborers, pick and shovel men in construction operations, remain at the July rate of 54c. as against 53c. per hr. during June, according to *Engineering News-Record* figures. Local building conditions are as follows:

Atlanta—Building permits indicate that peak has been reached; slowing down expected.

Baltimore—Scarcity of bricklayers, carpenters, hod carriers and common laborers. Conditions otherwise normal.

Boston—Scarcity of bricklayers, carpenters, and pile drivers; plenty of other crafts. Bricklayers attracted to New York by higher wages. Minim[illegible]

CURRENT BUILDING TRADES WAGE RATES PER HOUR

(Higher rates indicated by +, decreases by —)

Cities	Bricklayers	Carpenters	Hoisting Engineers	Hod Carriers	Pile Drivers	Structural Iron Workers	Common Labor
Atlanta	$1.12½	$0.90	$0.70	$0.50	.....	$0.75	$0.30@.35
Baltimore	1.50	1.00	.80@1.00	.87½	$0.65	.80@1.00	.30@.50
Birmingham	1.00	1.00	.50@1.00	.30@.40	.....	1.25	.30@.40
Boston	1.25	1.05	+1.25	.82½	1.05	1.12½	.55@.70
Cincinnati	1.25	1.05	1.05	.82½	1.05	1.05	.45
Chicago	1.25	1.15	1.00@1.25	.88¾	1.10	1.25	.82½
Cleveland	1.40	1.25	1.25	.87½	1.00	1.10	.87½
Dallas	1.50	1.00	1.00	.40	.87½	1.00	.30@.50
Denver	1.37½@1.50	1.12½	1.12½@1.18¾	.75@.81¼	1.00	1.15⅝	.35@.55
Detroit	1.12½	.80	.80@.90	.50@.60	1.00	.60@.80	.50
Kansas City	1.37½	1.00	1.00@1.25	.90	1.00	1.15	.35@.60
Los Angeles	1.25	.87½@1.00	.87½@1.00	.62½	.....	1.00	.50
Minneapolis	1.12½	.87½	.87½	.71½	.....	.87½	.55
Montreal	1.00	.65	.50	—.35	.50	.65	—.30
New Orleans	1.00	.90	.90	.65	.80	1.00	.35@.40
New York	1.50	1.25	1.50	1.00	1.00	1.12½	+.65@.75
Pittsburgh	1.40	1.20	1.12½	1.00	.....	1.25	.60
St. Louis	+1.50@1.75	1.25	1.25@1.37½	1.25	1.25	+1.25@1.50	+.50@1.00
San Francisco	1.25	1.00	1.00	81¼	1.00	1.12½	.50@.55
Seattle	1.12½	1.00	1.00	.93¾	1.00	1.12½	.50@.62½
Philadelphia	1.37½	1.12½	1.00	.75@1.00	1.10	1.10	.50@.65

rate to hoisting engineers advanced 25c.

Dallas—Excessive demand for bricklayers. Slight unemployment in common labor.

Detroit—Conditions normal in all trades.

Kansas City—Scarcity of bricklayers and carpenters; plenty of other crafts.

Montreal—Scarcity of bricklayers; carpenters not plentiful. Ample supply of other trades. Common labor wage rate at maximum of 30c., against 35c. per hr., last month.

New Orleans—Carpenters on strike since July 17, demanding "closed shop" at present rate or $1 per hr. with "open shop" conditions. No other crafts have struck in sympathy, as anticipated. Exodus of negro labor to North seriously affecting agricultural interests.

New York—All trades working. Construction has fallen off to a degree consistent with the supply of labor. Cement workers called off strike, accepting 93¾c. as against 81¼c. per hr. Difficulty experienced in obtaining bricklayers to work on school construction at established rate of $12 per day, when other building operations offer as high as $16. Tendency toward cost stabilization has prompted builders to lift ban on new construction projects.

St. Louis—Shortage of bricklayers and hod carriers. Carpenters union has voted to demand $1.50 per hr., an advance of 25c. The union has no contract with the builders. Jurisdictional dispute exists between carpenters and metal workers as to installation of metal trim. Bricklayers, structural iron workers and common laborers receiving higher wages than month ago.

San Francisco—All building crafts busy. Active construction program in sight.

Monthly Prices of Construction Materials

Ups and Downs of the Market

Pig Iron—Birmingham base on No. 2 foundry, $25 as against $27 per gross ton, one month ago. Lower prices tempting heavier volume of inquiries. New buying continuing on better scale but in small tonnages. Foundry and bessemer expected to develop firmer tendencies.

Railway Supplies—Track accessories in good demand; prices firm at July levels. Slight downward tendency in rerolled rails at Pittsburgh.

Pipe—No changes in prices of wrought steel and iron pipe, cast-iron pipe and clay drain tile. Buying of merchant steel pipe improved. Sewer pipe advanced slightly in Dallas and declined in Atlanta, during month

Road and Paving Materials—Crude oil output at new high mark. Road-oils' prices unchanged. Bulk asphalt declined slightly in Boston and Cincinnati. Granite paving blocks, 5-in., dropped $5 per M. in Boston. Wood-block paving declined slightly in Boston and New York.

Sand, Gravel and Crushed Stone — Gravel, ¾-in., dropped 50c. in New York, 10c. in St. Louis and advanced 13c. per cu.yd. in Dallas, during month. Sand declined 6c. in Dallas and 10c. per ton in Cincinnati. Crushed stone remained firm in nineteen cities reporting to *E. N.-R.*, with the exception of a slight advance in St. Louis.

Lime—Boston and Atlanta report declines both in hydrated and lump. Common lump, however, advanced sharply in San Francisco. New York prices remain unchanged despite shortage of finishing lime.

Cement—Mill prices firm. Price advanced 10c., f.o.b. Boston and Kansas City and 11c. per bbl. in Duluth, Minneapolis and St. Paul. San Francisco, however, reports drop of 8c. per bbl. in month.

Structural Steel—Buying on the increase, particularly in plates. Oil-storage tank, car materials and track accessories requirements taking bulk of business. Price of plates and shapes firm at $2.50 per 100 lb., Pittsburgh, for shipments at convenience of mill; as high as $2.60, however, obtained for small lots, or where immediate deliveries are required. Structural inquiries better; confined to small tonnages.

Brick and Hollow Tile — Common brick advanced from $20 to $21@$22 per M., wholesale, alongside dock, New York, since July 5. Slight rise also reported in Birmingham. Brick dropped 50c. in Boston; $1 in Detroit and $2 per M. in Atlanta. Hollow tile declined in St. Louis and Atlanta, and advanced slightly in Boston, during month.

Lumber—Price tendency continues downward throughout the country owing to decrease in demand. New York reports drop of $1 and Chicago, $2 per M. ft. in yellow pine timbers, during month. Declines also reported in New Orleans, Atlanta, Dallas and Birmingham. Slight advances, however, developed in Boston, Baltimore, Denver, Minneapolis, Kansas City and Detroit.

Explosives—Dynamite, 40 and 60 per cent gelatin, declined in Dallas and Minneapolis, and advanced in St. Louis, during month.

Scrap—Iron and steel scrap lower than month ago in New York and St. Louis. Firm at present levels.

Linseed Oil—Raw oil dropped 8c. per gal. in New York since July 5. Chicago prices unchanged in month. Tending downward in Atlanta, Dallas, Minneapolis and Denver.

Price advances since last month are indicated by **heavy type**; declines by *italics*

PIG IRON—Per Gross Ton—Quotations compiled by The Matthew Addy Co.:

	Aug. 2	One Year Ago
CINCINNATI		
No. 2 Southern (silicon 2.25 @ 2.75)	$29.05	$25.50
Northern Basic	29.27	26.52
Southern Ohio No. 2 (silicon 1.75 @ 2.25)	29.27	26.52
NEW YORK, tidewater delivery		
Southern No. 2 (silicon 2.25 @ 2.75)	34.26	31.66
BIRMINGHAM		
No. 2 Foundry (silicon 2.25 @ 2.75)	25.00	20.50
PHILADELPHIA		
Eastern Pa., No. 2X, (2.25@ 2.75 sil.)	28.76	28.32
Virginia No. 2 (silicon 2.25 @ 2.75)	32.17	29.74
Basic	27.76	26.00
Gray Forge	27.26	26.00
CHICAGO		
No. 2 Foundry Local (silicon 1.75 @ 2.25)	29.11	24.50
No. 2 Foundry Southern (silicon 2.25 @ 2.75)	30.51	27.17
PITTSBURGH, including freight charge from the Valley		
No. 2 Foundry Valley (silicon 1.75 @ 2.25)	27.77	25.50
Basic	26.77	25.50
Bessemer	28.77	25.50

SCRAP—The prices following are per gross ton paid to dealers and producers f.o.b. New York. In Chicago and St. Louis the quotations are per net ton and cover delivery at the buyer's works, including freight transfer charges.

	New York	Chicago	St. Louis
No. 1 railroad wrought	$15.00	$11.50	*$15@ 16*
Stove plate	*11.00*	12.00	*14@ 15*
No. 1 machinery cast	*17.00*	16.50	*18.50@ 20.00*
Machine shop turnings	*9.00*	4.00	*11@ 12*
Cast borings	*10.00*	5.50	*12@ 13*
Railroad malleable cast	13.00	12.50	20.00
Re-rolling rails	13.00	13.00	*18.50*
Re-laying rails	.....	30.00	*28.00@ 35.50*
Heavy melting steel	*11.50*	.....	.....

RAILWAY SUPPLIES

STEEL RAILS—The following quotations are per ton f.o.b. Pittsburgh and Chicago for carload or larger lots. For less than carload lots 5c. per 100 lb. is charged extra:

	Pittsburgh				
	Aug. 2	One Year Ago	Birmingham	Chicago	St. Louis
Standard bessemer rails	$43.00	$40.00		$43.00	$43.00
Standard openhearth rails	43.00	40.00	$43.00	43.00	43.00
Light rails, 8 to 10 lb.	45.00	35.00	2.00*	43.00	*43@ 45*
Light rails, 12 to 14 lb.	45.00	35.00	2.00*	43.00	*43@ 45*
Light rails, 25 to 45 lb.	45.00	35.00	2.00*	43.00	*43@ 45*
Rerolled Rails	*18.75@ 19.25*	28.00	.....	.....	.....

*Per 100 lb.

RAILWAY TIES—For fair-sized orders, the following prices per tie hold:

	6 In. x 8 In. by 8½ Ft.	7 In. x 9 In. by 8½ Ft.
Chicago, White Oak	$1.50	$1.65
Chicago, Hardwood and Red Oak	1.25	1.40
Chicago....Empty Cell Creosoting (add'l)	.45	.50
San Francisco..... Green Douglas Fir	.84	1.14
San Francisco, Empty Cell Creosoted Douglas Fir	1.70	2.25
St. Louis, White Oak	1.30	1.55
St. Louis (creosoted) (zinc treated)	1.70	2.05
St. Louis, Red Oak, plain	1.20	1.45
St. Louis, Sap pine-cypress	1.05	1.30

TRACK SUPPLIES—The following prices are base per 100 lb. f.o.b. Pittsburgh for carload lots, together with the warehouse prices at the places named:

	Pittsburgh				San Francisco	Birming-ham
	Aug. 2	One Year Ago	Chicago	St. Louis		
Standard spikes, ⅝-in. and larger	$3.15	$2.25@ 2.35	$3.00	$4.00	$5.00	$3.75
Track bolts	4.00@ 4.25	3.00@ 3.50	4.00	5.00	6.20	4.70
Standard section angle bars	2.75	2.40	2.75	4.00	4.25	3.10

PIPE

WROUGHT PIPE—The following mill discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

BUTT WELD

Inches	Steel Black	Steel Galv.	Inches	Iron Black	Iron Galv.
1 to 3	62	50½	⅜ to 1¼	30	13

LAP WELD

2	55	43½	2	23	7
2½ to 6	59	47½	2½ to 4	26	11
7 and 8	56	43½	4½ to 6	28	13
9 and 10	54	41½	7 to 12	26	11
11 and 12	53	40½			

BUTT WELD, EXTRA STRONG, PLAIN ENDS

1 to 1¼	60	49½	⅜ to 1¼	30	14
2 to 3	61	50½			

LAP WELD, EXTRA STRONG, PLAIN ENDS

2	53	42½	2	23	9
2½ to 4	57	46½	2½ to 4	29	15
4½ to 6	56	45½	4½ to 6	28	14
7 and 8	52	39½	7 and 8	21	7
9 and 10	45	32½	9 to 12	16	2
11 and 12	44	31½			

WROUGHT PIPE—From warehouses at the places named the following discounts hold for steel pipe:

	Black		
	New York	Chicago	St. Louis
1 to 3 in. butt welded	48%	50%	40%
2½ to 6 in. lap welded	44%	47%	46%
	Galvanised		
	New York	Chicago	St. Louis
1 to 3 in. butt welded	34%	37%	36%
2½ to 6 in. lap welded	30%	34%	33%

Malleable fittings, Classes B and C, banded, from New York stock sell at list plus 15%. Cast iron, standard sizes, 17½% off.

CAST-IRON PIPE—The following are prices per net ton for carload lots:

	Birmingham Mill	New York Aug. 2	New York One Year Ago	Chicago	St. Louis	San Francisco
4 in.	$53.00	$67.30	$58.30	$64.20	$61.60	$66.00
6 in. and over	49.00	62.30	53.30	60.20	57.60	62.00

Gas pipe and Class "A," $5 per ton extra; 16-ft. lengths, $1 per ton.

CLAY DRAIN TILE—The following prices are per 1000 lin.ft.:

	New York					
Size, In.	Aug. 2	One Year Ago	St. Louis	Chicago	San Francisco	Dallas
3	$45.00	$40.00	$50.00	$62.50	.....	$73.00
4	55.00	50.00	50.00	75.00	$76.50	83.00
5	80.00	80.00	.....	100.00	97.75	108.00
6	105.00	100.00	85.00	125.00	127.50	133.00
8	170.00	150.00	105.00	187.50	212.50	199.00

SEWER PIPE—The following prices are in cents per foot for standard pipe in car load lots, f.o.b., except as otherwise stated:

Size, In	New York Delivered	Pittsburgh	Birmingham	St. Louis	Chicago	San Francisco	Dallas
3	.....	$0.114	.....	.....	$0.15	$0.12	.....
4	.....	.114	$0.11	$0.1175	.15	.15	$0.15
5	.....	.171	.1375	.....	.23	.18	.18
6	$0.24	.171	.165	.1645	.23	.21	.21
8	.38	.266	.26	.26	.35	.30	.325
10	.57	.399	.338	.364	.53	.42	.476
12	.72	.513	.442	.468	.68	.54	.612
15	1.13†	.684	.65	.781	.90	.90	.884
18	1.65†	.95	.85	1.092†	1.25	1.32	1.156
20	1.98†	1.14	1.125	.....	1.50	.....	.....
22	2.64†	1.52	1.375	1.456†	2.00	.....	1.564
24	2.97†	1.71	1.625	1.872†	2.25	2.16	2.04
27	4.81†	2.99	....	2.95†	4.69†	3.00	3.34
30	5.33†	3.312	....	3.65†	5.94†	3.60	4.06
33	6.93†	4.41	....	4.45†	6.88†	.....	4.99
36	7.91†	5.0225	....	4.80†	7.50†	.....	5.42
	3	5	8	12	24	36	
Boston	$0.127	$0.195	$0.308	$0.595	$1.975†	$5.90†	
Minneapolis	.....	.....	.40	.72	2.55	5.66†	
Denver	.135*	.18*	.27	.47	1.70	.....	
Seattle	.13	.....	.36	.72†	2.60†	.....	
Los Angeles	.13	.165	.275	.425	1.65	.....	
New Orleans	.112*	.168*	.28	.476	1.182	.....	
Cincinnati	.12	.18	.28	.54	1.80	4.10†	
Atlanta	*1.05**	*.16**	*.27*	*.455*	*1.75*	.....	
Montreal, *delivered*	.68‡	.45†	.70	1.35	4.50†	.....	
Detroit	.117	.1755	.273	.5265	2.34†	6.15†	
Baltimore	.126	.189	.294	.567	1.89	5.4375	
Kansas City, Mo	.15*	.21	.33	.40	1.60	.....	
Philadelphia	.....	.....	.....	.....	.....	.....	

*4-in., 6-in., 9-in., respectively. †Double Strength. ‡3-in. special.

ROAD AND PAVING MATERIALS

ROAD OILS—Following are prices per gallon in tank cars 8,000 gal. minimum f.o.b. place named:

		Aug. 2	One Year Ago
New York, 45% asphalt	(at terminal)	$0.0525	$0.05
New York, 65% asphalt	(at terminal)	.0525	.045
New York, binder	(at terminal)	.06	.0575
New York, flux	(at terminal)	.0575	.055
New York, liquid asphalt	(at terminal)	.06	.06
St. Louis, 50@ 60% asphalt		.0565	.05
St. Louis, 40@ 50% asphalt		.0535	....
Chicago, 40–50% asphalt		.0525	.0525
Chicago, 60–70% asphalt		.055	.055
Dallas, 45% asphalt		.049	.10
Dallas, 55% asphalt		.0455	.13
Dallas, binder		.061	.15
San Francisco, binder, per ton		9.50*	13.00*

* F.o.b. Oleum, Cal. Freight to San Francisco, 80c. per ton.

ASPHALT—Price per ton in packages (350-lb. bbls. or 425-lb. drums) and in bulk in carload lots, f.o.b. points listed:

	Package	Bulk
New York (*Mexican*)	$19.00	$15.00
Boston (*Mexican*)	*20.50*	*16.50*
Chicago (*Stanolind*)	22.25	16.00
San Francisco, *f.o.b. refinery*, Oleum, Cal.	17.00*	11.00*
Dallas, (*Texas*)	27.10	21.10
Seattle, "*D*" *grade* (*California*)	24.75	20.50‡
Denver (*California*)	24.00	.....
Minneapolis *f.o.b. Twin Cities* (*Stanolind*)	25.45	19.10
St. Louis (*Mexican*)	29.50	24.50
Baltimore (*Standard Oil*)	21.00	15.00
Montreal (*Imperial*)	28.00	21.00
Atlanta (*Mexican*)	26.00	23.50
Detroit (*Mexican*)	22.47	18.40
Cincinnati (*Kentucky Rock*)	23.40	*19.50*
Maurer, N. J. (*Bermudez*)	28.00	26.00
Maurer, N. J. (*Mexican*)	21.50	18.50
Philadelphia (*Mexican*)	.....	.....
Kansas City (*Texas*)	27.30	22.30
Los Angeles "*D*" *grade* (*California*)	17.00‡	11.00‡

*Freight to San Francisco, 80c. per ton.
†F.o.b. Richmond, Cal.
‡F.o.b. El Segundo refinery.

NOTE—Barrels or drums are optional in most cities. About 6 bbls. to the ton, and from 4 to 5 drums; 200 to 300 gal. to the ton.

PAVING STONE—

New York (grade I)	5-in. granite, 30 blocks per sq.yd.	$134.50 per M.
Chicago	About 4x8x4 dressed	3.50 per sq.yd.
	About 4x8x4 common	3.10 per sq.yd.
San Francisco	Basalt block 4x7x8	70.00 per M.
Boston	5-in. granite, 28 blocks per sq.yd.	*130.00* per M.
Atlanta	Granite	2.66 per sq.yd.
Detroit	5-in. Granite	106.00 per M.
Baltimore	Granite	2.85 per sq.yd.
Montreal	Granite	100.00 per M.
New Orleans	Granite, 4 x 8 x 4	3.25 per sq.yd.
Cincinnati	Granite	138.00 per M.
St. Louis	4x8x4 dressed	3.15 per sq.yd.
	4x8x4 common	2.95 per sq.yd.
Kansas City	Granite	3.55 per sq.yd.
Philadelphia	Granite	..... per M.
Minneapolis	Sandstone	2.74 per sq.yd.

FLAGGING—

New York	Bronx, 4 ft wide	$0.22 per sq.ft.
	Manhattan, 4 ft. wide	.22 per sq.ft.
	Queens, 5 ft. wide	.24 per sq.ft.
	6x24-in. cross-walk	1.10 per lin.ft.
Chicago	18 in. wide	..... per lin.ft.

CURBING—*New York*: Bluestone per lin.ft., f.o.b. barge New York, 5 x 16 in., 80c.; 5 x 20 in., Queens, 85c. *St. Louis*: Class "A" straight, delivered, 5 x 16 in., $1.45 per lin.ft. *Chicago*: 5 x 8 in., $1.65; 6 x 8 in., $1.95 per lin.ft. delivered.

WOOD BLOCK PAVING—

	Size of Block	Treatment	Per Sq.Yd.
New York (*delivered*)	3	16	*$2.58*
New York (*delivered*)	3½	16	2.79
Boston	3½	18	*2.67*
Chicago	4	16	3.00@3.25
Chicago	3½	16	2.50
St. Louis	3½	16	2.55
St. Louis	4	16	2.90
Seattle	4	16	Off market
Minneapolis	3½	16	2.73
Atlanta	3½	16	2.00
New Orleans	3	16	2.45
New Orleans	3½	16	2.65
New Orleans	4	16	2.95
Dallas	4	18	3.90
Baltimore	3½	16	none used
Montreal	4	16	4.50
Detroit	3	16	2.84
Detroit	4	16	3.00
Cincinnati	3½	16	2.38
Kansas City	4	16	2.75
Philadelphia	4	16	.....

CONSTRUCTION MATERIALS

SAND AND GRAVEL—Price for cargo or carload lots to contractor is as follows, per cu.yd.:

	Gravel 1½ In. Aug. 2	Gravel 1½ In. One Year Ago	Gravel ¾ In. Aug. 2	Gravel ¾ In. One Year Ago	Sand Aug. 2	Sand One Year Ago
New York	$1.75	$1.75	*$1.75*	$1.75	$1.25	$1.00
Denver	1.90	1.75	1.90	1.75	1.00	0.75
Chicago	2.00	1.80	2.00	1.80	2.00	1.80
St. Louis	*2.30*	1.25†	*2.35*	1.30†	2.10	1.10†
Seattle	1.25	1.25	1.25	1.25	1.25	1.25
Dallas	2.38	2.25	2.38	2.25	*1.89*	2.25
Minneapolis	1.85*	1.50	1.85*	1.50	1.25	1.00
Cincinnati	1.50†	1.87½	1.50†	1.87½	*1.20*†	1.43
San Francisco	2.15	2.25	2.15	2.25	1.50	1.50
Boston	1.50†	2.40	1.50†	2.40	1.20†	1.65
New Orleans	2.85	2.08½	2.85	2.08½	1.25	1.35
Los Angeles	2.75	1.50†	2.75	1.50†	1.75†	1.35†
Atlanta	1.90†	1.85†	1.90†	1.85†	1.24†	1.15†
Detroit	1.62	2.00	1.62	2.00	2.02½	2.00
Baltimore	1.86	1.40	2.06	1.60	0.80†	2.00†
Montreal	1.25†	1.25†	1.50†	1.50†	1.25†	1.25†
Birmingham (Crushed slag used instead of gravel)					1.30†	1.28†
Philadelphia		1.55		1.60		1.60
Kansas City	1.75	2.00	1.60	2.00	0.66†*	1.20

New York—Grit, $1.75 per cu. yd.; ready mixed, *$2.00*
Los Angeles—Freight from quarry, 70c. per ton, and is included in above price.
* At pit.
† Per ton

CRUSHED STONE—Price for cargo or carload lots f.o.b. city, unless stated otherwise, is as follows, per cu.yd.:

	1½ In. Aug. 2	1½ In. One Year Ago	¾ In. Aug. 2	¾ In. One Year Ago
New York	$1.65	$1.65	$1.75	$1.75
Chicago	2.00	1.60	2.00	1.60
St. Louis	1.90	1.65	1.70	1.65
Dallas	2.50	2.73	2.50	2.73
San Francisco	2.15	2.25	2.15	2.25
Boston	1.70*	3.00*	1.70*	3.00*
Minneapolis, *at plant*	2.00	2.00	2.25	2.25
Kansas City	1.50	2.10	1.50	2.10
Denver	3.50	3.50	3.50	3.50
Seattle	3.00	3.00	3.00	3.00
Atlanta	2.00*	1.90*	2.00*	1.90*
Cincinnati	1.65*	1.75	1.65*	1.75
Los Angeles *delivered*	3.25	1.75*	3.25	1.75*
Detroit	1.75	1.90*	1.75	1.90*
Baltimore	2.50	1.75*	2.55	1.75*
Montreal	1.80*	1.50*	1.90*	2.00*
Philadelphia	.....	1.70*	.....	1.55*
Pittsburgh	2.85	2.85	2.85	2.55
Cleveland	3.25*	3.00*	3.25*	3.00*

*Per ton.

CRUSHED SLAG—Price of crushed slag in carload lots per net ton, at plants:

	1½-In.	¾-In	Roofing	Sand
Youngstown District	$1.30	$1.40	$2.00	$1.30
Steubenville District	1.40	1.40	2.00	1.40
Ironton District	1.40	1.40	2.00	1.40
Easton, Catasauqua, Pa	0.85	0.90	2.50	.....
Birmingham, Ala	1.05	1.15	2.05	0.85
Buffalo, N. Y., and Erie, Pa	1.25	1.25	2.25	1.25
Cleveland, Ohio	1.45	1.45	1.45	1.25
Eastern Pa. and Northern N. J	1.20	1.20	2.50	1.20
Western Pennsylvania	1.25	1.25	2.00	1.25
Longdale and Glen Wilton, Va	1.25	1.25	2.50	1.00
Toledo, Ohio	1.50	1.50	1.50	1.50

LIME—Warehouse prices.

	Hydrated, per Ton Finishing	Hydrated, per Ton Common	Lump, per Barrel Finishing	Lump, per Barrel Common
New York	$18.20	$13.10	$3.75*	$3.00@3.25*
Chicago	20.00	20.60	1.50†	1.50†
St. Louis	23.20	20.00	.....	.....
Boston	*22.00*	*17.00*	*4.15**	*3.45**
Dallas	22.00	.....	.....	2.35†
Cincinnati	16.80	14.30	.....	.....
San Francisco	22.00	.....	.....	2.10†
Minneapolis	25.50	21.00 (white)	1.70†	1.50†
Denver	24.00	.....	.....	2.70†
Detroit	21.00	20.00	.....	20.00‡
Seattle, *paper sacks*	24.00	.....	2.80†	.....
Los Angeles	.....	.....	.....	2.60*
Baltimore	24.25	17.25	2.55	.....
Montreal	21.00	21.00	.....	10.00‡
Atlanta	*22.50*	*14.00*	*2.25*†	1.50†
New Orleans	.....	.....	2.40†	1.85†
Philadelphia	.....	.....	.....	.....
Kansas City	28.00	24.00	3.12*	2.96*
Birmingham	14.25	13.50	1.90†	1.65†

*Per 280-lb. bbl. (net). †Per 180-lb. bbl. (net). ‡Per ton—Refund of 10c. per bbl. Minneapolis quotes brown common lump lime; Kelly Is. white is $1.80, Sheboygan $1.70. New York quotes hydrated lime "on cars" in paper sacks; lump lime "alongside dealers docks" or "on cars."

NATURAL CEMENT—Price to dealers per bbl. for 500 bbl. or over, f.o.b., exclusive of bags:

	Aug. 2	One Year Ago
Minneapolis (Rosendale)	$2.80	$2.80
Kansas City (Ft. Scott)	1.50	1.60
Cincinnati (Utica)	1.72	1.77
Boston (Rosendale)	2.70	0.80 per bbl
St. Louis (Carney)	*2.45*	2.10
Birmingham (Magnolia) pozzolan cement	2.10	.....

PORTLAND CEMENT—Prices to contractors per bbl. in carload lots f.o.b. points listed *without bags*. Cash discount not deducted.

	Aug. 2	One Month Ago	One Year Ago
New York, del. by truck	$2.70@2.80	$2.70@2.80	$2.40@2.50
New York, alongside dock to dealers	2.30	2.30	2.10
Jersey City	2.48	2.48	2.28
Boston	2.90	2.80	2.50
Chicago	2.20	2.20	2.05
Pittsburgh	2.24	2.24	2.09
Cleveland	2.46	2.46	2.31
Detroit	2.48	2.48	2.33
Indianapolis	2.41	2.41	2.26
Toledo	2.48	2.48	2.33
Milwaukee	2.37	2.37	2.22
Duluth	2.25	2.14	2.14
Peoria	2.41	2.41	2.26
Cedar Rapids	2.48	2.48	2.33
Davenport	2.43	2.43	2.28
St. Louis	2.35	2.35	2.20
San Francisco	*2.63*	2.71	2.71
New Orleans	3.30	3.30	3.20
Minneapolis	2.50	2.39	2.39
Denver	2.84	2.84	2.85
Seattle	2.90	2.90	2.90
Dallas	2.25	2.25	2.25
Atlanta	2.85	2.85	2.50
Cincinnati	2.54	2.54	2.39
Los Angeles	*3.16*	3.20	3.30
Baltimore	2.55	2.65	2.50
Birmingham	2.70	2.70	2.10
Kansas City	2.55	2.45	2.40
Montreal	2.25	2.25	2.78
Philadelphia	.....	.....	2.31
St. Paul	2.50	2.39	2.39

NOTE—Bags 10c. each, 40c. per bbl.; 20c. each in Canada, 80c. per bbl.

Current mill-prices per barrel in carload lots, without bags, to contractors:

Buffington, Ind.	$1.95	Hudson, N. Y.	$2.20
Universal, Pa.	2.00	Leeds, Ala.	2.20
Steelton, Minn.	2.06	Hannibal, Mo.	2.10
Fordwick, Va.	2.10	Lehigh Valley District	2.10
Mitchell, Ind.	2.10	Wyandotte, Mich.	2.30
Iola, Kan.	2.10	Alpena, Mich.	2.10
Mason City, Ia.	2.10	Richard City, Tenn.	2.20
La Salle, Ill.	2.10	Kingsport, Tenn.	2.20

TRIANGLE MESH—Price per 100 sq.ft in carload lots:

PLAIN 4-INCH BY 4-INCH MESH

Style Number	Weight in Pounds per 100 sq.ft.	Pittsburgh Mill	Chicago Mill	Warehouse New York	Warehouse St. Louis	Warehouse Dallas	San Francisco
032	22	$0 95	$1 02	$1 24	$1 04	$1 12	$1 16
049	28	1 20	1 30	1 58	1 32	1 38	1 47
068	35	1 47	1 59	1 94	1 62	1 67	1 81
093	45	1 89	2 04	2 50	2 08	2 00	2 32
126	57	2 34	2 53	3 09	2 59	2 55	2 88
153	68	2 79	3 02	3 60	3 08	3 15	.....
180	78	3 20	3 47	5 22	3 54	3 47	.....
245	103	4 22	4 57	4 60	4 66	4 58	.....
287	119	4 88	5 28	6 44	5 39	5 26	6.00
336	138	5 66	6 13	7 39	6 25	6 11	.....
395	160	6 56	7 10	8 67	7 25	7.12	.....

PAVING

036P	17	$0 72	$0 78	$0 95	$0 79	$0.76	.....
053P	24	1 02	1 10	1 35	1 12	1 07	.....
072P	31	1 29	1 40	1 71	1 42	1 39	.....
097P	40	1 66	1 80	2 20	1 83	1 90	.....
049P	24	....	1 10	....	1 12	1 07	.....
067P	31	....	1 40	....	1 42	1 39	.....
089P	40	....	1 80	....	1 83	1 90	.....

In rolls, 48-, 52-, and 56-in. wide and in 150-, 200- and 300-ft. lengths. Galvanized is about 15% higher. Size of roll carried in New York warehouses, 48 in. wide x 150 ft. long, or 600 sq. ft.

EXPANDED METAL LATH—Prices in carload lots per 100 yd. for painted are as follows:

Gage	Weight	*New York	Chicago	St. Louis	San Francisco	Dallas
27 Dia.	2 3	$22 00	$21 25	$20 72	$21 43	$25.50
26 "	2 5	22 00	22 50	22 39	20 78	27 58
25 "	3.0	22 00	25 25	24 93	.....	30 71
24 "	3 4	24 00	27 25	27 10	24 88	33 16
22 "	4 33	27 00	31 75	32 27	.....	35 10

* Price to contractors at warehouse or delivered on job in Manhattan, Bronx or Brooklyn.

BARS, CONCRETE REINFORCING—Current quotations per 100 lb.:

ROLLED FROM BILLETS

Inches	Pittsburgh Mill	Birmingham Mill	New York	Warehouse, Uncut Chicago	St. Louis	Dallas	San Francisco
¼ and larger..	$2 40	$2 65	$3 54	*3 20*	$3.35	$3 80	$3 65
⅜	2 45	2 75	3 59	*3 25*	3 40	3 85	3 70
½	2 50	2 85	3 64	*3 30*	3 45	3 90	3 75
⅝	2 65	2 90	3 69	*3 45*	3 60	4 05	3 90
¾	2 90	2 95	4 04	*3 70*	3 85	4.30	4.15

Includes 15c charge for cutting to lengths of 2 ft. and over.
Twisted bars cut to length take extra of 27½c. per 100 lb.

ROLLED FROM RAILS

	Chicago	St. Louis	Dallas		Chicago	St. Louis	Dallas
¼ and larger	$2 30	$3.05	$3 50	⅝	$2 55	$3 30	$3 75
⅜ in.....	2 35	3.10	3 55	¼	2 80	3.50	4 00
½	2.40	3.15	3 60	.....	.....	.....	.....

BRICK—Contractors price per 1,000 in cargo or carload lots is as follows:

	Common Aug. 2	Common Month Ago	Common One Year Ago	Paving Block 3-inch*	Paving Block 4-inch*
New York (del.).	$24.60@25.70	$23.50	$23.50	$46.50	$54 00
New York (at dock)....	21@22	20.00	20.00	.....	.....
Chicago	11 00	11 00	11 00	34 00	42 00
St. Louis, salmon.....	16@18	16@18	14 00	38@40	40@44.50
Denver, salmon.....	12 00	12.00	12 00	.....	.....
Dallas	13 10	13 10	11 15	33.00	.....
San Francisco	15 00	15 00	15 00	.....	.....
Los Angeles (del.).....	16 00	15 00	15.00	(not used)	
Boston (del.)	*22 00*	22.50	16 00	48.25	56.00
Minneapolis (del.).....	17@19	17@19	17@18	.....	.....
Kansas City.....	14 50	14 50	14 50	.....	.....
Seattle	13 00	13 00	14 00	50 00	.....
Cincinnati	17@20	17@20	15.00	45.00	50.00
Montreal	16 50	16 50	16 00	100.00‡	68 00
Detroit (del.)	*19 00*	20 00	16 50	38 50	41.50
Baltimore (del.).....	21.00	21.00	20.00	40.00	45.00
Atlanta	*12 00*	14 00	11 00	40.00	45.00
New Orleans.....	18 75	18 75	12 50	.....	.....
Birmingham	13.50@16	13@16	12.00	.....	.....
Philadelphia	.....	.....	17.50@18.50	40.00	48.00
Pittsburgh (del.).....	16.00	16.00	16.00	.....	.....
Cleveland	16.00	16.00	14 00	.....	.....

* For paving blocks 3½x8½x3 and 3½x8½x4 respectively. † F.o.b. ‡Imported.

HOLLOW TILE—Price per block in carload lots to contractor for hollow building tile.

	New York Aug. 2 on Trucks*	New York One Year Ago	Chicago	Philadelphia	St. Louis	San Francisco	Perth Amboy N. J., Factory*
4x12x12...	$0.1573	$0.1112	$0.0724	.....	$ 092	$0.108	.....
6x12x12...	2097	.1667	.0996	.....	.126	.156	.....
8x12x12...	2621	.2084	.1358	.....	170	.244	$0.2691
10x12x12...	.....	.....	.1695	.....	*.19*	.....	.3505
12x12x12...	.....	.....	.1937	.....	*.236*	.....	.4206

* 5 per. off for cash.

	4x12x12	8x12x12	12x12x12
Boston	$0.16	$0.225	.....
Minneapolis (f.o.b. cars).....	.0736	.12125	$0.214
Minneapolis (delivered)	.0816	.13375	.234
Cincinnati	.0815	.153	....
Kansas City.....	.083	.1455	.....
Denver.....	.065	.123	.188
Seattle (delivered)	.11	.25	.36
Los Angeles factory.....	.10	.175	....
New Orleans.....	.12	.23	.....
Detroit (delivered).....	.1145	.2147	.27
Montreal.....	.115	.225	.30
Baltimore.....	.125	.27	.....
Atlanta.....	*.102*	*.175*	.....
Dallas.....	.115	.....	.....
Birmingham.....	.11	.18	.....
Pittsburgh (delivered).....	.068	.128	.179
Cleveland	.09	.172	.....

San Francisco and New York quote on hollow partition tile.

STRUCTURAL MATERIAL—Following are base prices f. o. b. mill, Pittsburgh and Birmingham, together with quotations per 100 lb. from warehouses at places named:

	Pittsburgh Mill	Birmingham Mill	Warehouse New York	Warehouse Dallas	Warehouse St. Louis	Warehouse Chicago	San Francisco
Beams, 3 to 15 in....	$2 50	$2 75	$3.64	$4.20	$3 45	$3.40	*$3 60*
Channels, 3 to 15 in....	2 50	2 75	3 64	*4 20*	3 45	3 40	*3 60*
Angles, 3 to 16 in., ¼ in. thick	2 50	2 75	3 64	*4 20*	3 45	3 40	*3 60*
Tees, 3 in. and larger	2 50	2 75	3 64	*4 20*	3 50	3 40	*3 60*
Plates, ¼ in. thick and heavier.....	2.50	2.75	3.64	*4.20*	3.45	3.40	*3.60*

RIVETS—The following quotations are per 100 lb.:

STRUCTURAL

	Pittsburgh Mill	New York Aug. 2	New York One Yr. Ago	Warehouse Chicago	Warehouse St. Louis	Warehouse San Francisco	Warehouse Dallas
½ in. and larger	*$3.15@3.25*	$4.40	$3.60	$3.75	$4.15	$5.00	*$4.20*

CONE HEAD BOILER

½ in. and larger	*$3.25@3.35*	$4 50	$3 70	$3 85	$4.25	$5 10	*$5.00*
⅝ and ¾.....	*3.50@3.50*	4.66	3 86	4 00	4.40	5 25	*5.15*
⅞ and 1.....	*3.65@3.75*	4.90	4 10	4.25	4.60	5.50	*5.40*

Lengths shorter than 1 in. take an extra of 50c. Lengths between 1 in. and 2 in. take an extra of 25c.

NAILS—The following quotations are per keg from warehouse:

	Pittsburgh Mill	Chicago	San Francisco	Dallas	St Louis	Montreal
Wire.....	$3.00	$3.45	*$4.20*	$4.25	*$3.45*	$4.95
Cut	....	5.50	5.80	5.75	*5.65*	5 00

SHIP SPIKES—Current prices per 100 lb.:

In.	San Francisco Galv.	San Francisco Black	Seattle Black
¼	$9.85	$7.65	$8.00
⅜	7.80	6.30	7.75
½	7.75	6.15	7.70

Pittsburgh base in lots of 200 kegs or more, $3.50@3.75.

PREPARED ROOFINGS—Slate-surfaced roofing (red and green) in rolls of 108 sq.ft. costs $2.50 per roll in less than carload lots f.o.b. Philadelphia.

Single shingles, red and green slate finish, cost $5.75 per square (sufficient to cover 100 sq.ft.) in less than carload lots, f.o.b. Philadelphia. Strip shingles (4 in 1) f.o.b. Philadelphia, l.c.l., *$5.85* per square.

ROOFING MATERIALS—Prices f.o.b. New York, in less than carload lots:

Tar felt (14 lb. per square of 100 sq.ft.) per ton.....	$67 50
Tar pitch (in 400-lb. bbl.), per 100 lb.....	1 62½
Asphalt roofing (in barrels), per ton, f.o.b. plant*.....	38.75
Asphalt felt (light), per ton, f.o.b. plant*.....	75.00
Asphalt felt (heavy), per ton, f.o.b. plant*.....	75.00

* Delivered in Metropolitan Dist., $3.00 additional.

WINDOW GLASS—Double strength, box list, united inches, 34, "AA" grade, at discount of 84 per cent from standard lists, f.o.b. New York; "A" grade less 86 per cent and "B" grade, 87 per cent.

SHEETS—Quotations are per 100 lb. in various cities from warehouse also the base quotations from mill:

Blue Annealed	Pittsburgh Large Mill Lots	St. Louis	Chicago	San Francisco	New York
No. 10.....	$3.00	$4.45	$4.15	$5.10	$4.59
No. 12.....	3.10	4.50	4.20	5.15	4.64
No. 14.....	3.20	4.55	4.25	5.20	4.69
No. 16.....	3.40	4.65	4.35	5.25	4.79
Black					
*Nos. 18 and 20.....	3.70	5.00	5.05	5.95	4.95
*Nos. 22 and 24.....	3.75	5.05	5.05	6.00	5.00
*No. 26.....	3.80	5.10	5.10	6.05	5.05
*No. 28.....	3.85	5.20	5.20	6.15	5.15
Galvanized					
No. 10.....	4.00	5.35	5.35	5.50	5.15
No. 12.....	4.10	5.45	5.45	5.60	5.25
No. 14.....	4.10	5.45	5.45	5.75	5.25
Nos. 17 to 21.....	4.40	5.75	5.75	5.90	5.55
Nos. 22 and 24.....	4.55	5.90	5.90	6.05	5.70
*Nos. 25 and 26.....	4.70	6.05	6.05	6.20	5.85
*No. 28.....	5.00	6.35	6.35	6.50	6.15

*For painted corrugated sheets add 30c. per 1,000 lb. for 5 to 28 gage; 25c. for 19 to 24 gages; for galvanized corrugated sheets add 15c., all gages.

LINSEED OIL—These prices are per gallon:

	New York Aug. 2	New York One Year Ago	Chicago Aug. 2	Chicago One Year Ago
Raw in barrels (5 bbl. lots)	*$1.05*	$0.91	$1.28	$1.01

WHITE AND RED LEAD—In 100-lb. kegs, base price in cents per pound:

	Dry		In Oil	
	Aug. 2	1 Yr. Ago	Aug. 2	1 Yr. Ago
Red	14.00	12.50	15.50	14.00
White	14.00	12.50	14.00	12.50

LUMBER

Prices wholesale, per M. ft. b.m., to dealers in carload lots, f.o.b.

San Francisco—Prices of rough Douglas fir No. 1 common, in carload lots to dealers at yards. To contractors, $2 per M. ft. additional.

	6-8 and 12 Ft.	10-16-18 and 20 Ft.	22 and 24 Ft.	25 to 32 Ft.
3x3 and 4	$40.00	$41.00	$42.00	$45.00
3x6 and 8	40.00	41.00	42.00	45.00
4x4-6 and 8	40.00	41.00	42.00	45.00
3x10 and 12	40.00	41.00	42.00	45.00
3x14	42.00	42.00	44.00	46.00
4x10 and 12	40.00	41.00	42.00	45.00
4x14	42.00	42.00	44.00	46.00

	24 Ft. and Under	25 to 32 Ft.	33 to 40 Ft.
6x10	$42.00	$44.00	$46.00
6x14	47.00	49.00	51.00
8x10	42.00	44.00	46.00
8x14	47.00	49.00	51.00

New York and Chicago—Wholesale prices to dealers of long leaf yellow pine.

	New York*		Chicago	
	20 Ft. and Under	22-24 Ft.	20 Ft. and Under	22-24 Ft.
3x4 to 8x8	*$50.00*	*$51.00*	*$50.50*	*$52.50*
3x10 to 10x10	*53.00*	*55.00*	*54.50*	*55.50*
3x12 to 12x12	*58.00*	*59.00*	*56.50*	*58.50*
3x14 to 14x14	*65.00*	*68.00*	*61.50*	*63.50*
3x16 to 16x16	*70.00*	*71.00*	*66.50*	*68.50*
3x18 to 18x18	*84.00*	*85.00*	*78.50*	*79.50*
4x20 to 20x20	*94.00*	*95.00*	*89.50*	*91.50*

*Wholesale price to dealers; to contractors, delivered from lighters or cars to job, $5 additional. Short leaf pine costs $3 per M. less.

Over 24 ft.—Add $1 for each additional 2 ft. in length up to 30 ft. for sizes 12 x 12 and under, for sizes over 12 x 12 add $2, for merchantable add $2 to sizes 10 x 10 and under.

Other Cities

	8x8-In. x 20 Ft. and Under				12x12-In. 20 Ft. and Under	
	P.	Fir	Hemlock	Spruce	P.	Fir
Boston	**$68.00**	.....	**$65.00**	$57.00	**$90.00**	.....
Seattle	.....	*$28.00*	.....	.....	.....	*$28.00*
New Orleans	*28.00*	.....	.....	.....	*31.00*	.....
Baltimore	33.50	53.00	53.00	60.00	**50.00**	53.00
Cincinnati	40.00	75.00	75.00	90.00	44.00	80.00
Montreal	50.00	.....	.....	.....	70.00	90.00
Los Angeles	.....	*50.00*	.....	.....	.....	*51.00*
Denver	40.75	**41.75**	**41.75**	**41.75**	.....	*42.75*
Minneapolis	43.50	**42.50**	41.50	.....	46.00	**44.75**
Atlanta	*36.00*	.....	.....	.....	*40.00*	.....
Dallas	*47.50*	.....	.....	.....	*52.25*	.....
Kansas City	44.25	**47.00**	**47.00**	.....	57.25	**49.00**
Birmingham	*30@35*	.....	.....	.....	*40@45*	.....
Philadelphia	.....	.....	.....	.....	.....	.....
Detroit	48.75	**54.00**	.....	.....	61.75	**54.00**
St. Louis	44.00	.....	.....	.....	56.00	.....

	1-In. Rough, 10 In. x 16 Ft. and Under			2-In. T. and Gr. 10 In. x 16 Ft.	
	P.	Fir	Hemlock	P.	Fir
Boston	$50.00	$90.00	$50.00	**$62.00**	.....
Seattle	.....	*24.00*	.....	.....	*$26.00*
New Orleans	*72.00*	.....	.....	*31.00*	.....
Baltimore	60.00	44.00	44.00	34.00	50.00
Cincinnati	76.00	81.00	76.00	35.00	90.00
Montreal	.....	50.00	37.00	45.00	45.00
Los Angeles	.....	*45.00*	.....	.....	.....
Denver	.....	*33.25*	*33.25*	.....	34.25
Minneapolis	43.50	41.75	39.50	40.25	38.25
Atlanta	*50.00*	.....	.....	*30.00*	.....
Dallas	*47.50*	.....	.....	*50.83*	.....
Kansas City	69.00	**44.00**	.....	**45.00**	**46.00**
Birmingham	*26@30*	.....	.....	*38@40*	.....
Philadelphia	.....	.....	.....	.....	.....
Detroit	**53.00**	39.00	.....	**47.00**	*41.25*
St. Louis	*44.00*	.....	.....	**37.00**	.....

Birmingham—Quotes carload lots, f.o.b. sidings; $4.00 additional per M.ft. to contractors.

Boston and Cincinnati—Prices to contractors in carload lots, f.o.b.

Denver—Quotes dealers price to contractors on large projects.

St. Louis—Wholesale price to contractors, f.o.b. cars, $3 per M.ft. additional.

Seattle—Price to contractors, delivered.

Dallas—Wholesale to contractors, $10 per M.ft. additional.

PILES—Prices per lineal foot, pine piles with bark on, f.o.b. New York.

Diameters	Points	Length	Barge	Rail
12 in. at butt	6 in.	30 to 50 ft.	$0.14½	$0.18½
12 in.—2 ft. from butt	6 in.	50 to 59 ft.	.19	.23½
12 in.—2 ft. from butt	6 in.	60 to 69 ft	.21½	.25½
14 in.—2 ft. from butt	6 in.	50 to 69 ft.	.25½	.34
14 in.—2 ft. from butt	6 in.	70 to 79 ft.	.27½	.36½
14 in.—2 ft. from butt	5 in.	80 to 89 ft.	.35	.41

MISCELLANEOUS

STEEL SHEETPILING—The following price is base per 100 lb. f.o.b. Pittsburgh, with a comparison of a month and a year ago:

Aug. 2	One Month Ago	One Year Ago
$2.65	$2.65	$2.00

WIRE ROPE—Discounts from list price on regular grades of bright and galvanized are as follows:

	Eastern New York and Missouri River	Territory East of
Hercules red strand, all constructions	20%	
Patent flattened strand, special steel wire rope	20%	
Patent flattened strand, iron rope	5%	
Plow steel round strand rope	35%	
Special steel round strand rope	30%	
Cast steel round strand rope	20%	
Round strand iron and iron tiller	5%	
Galvanized steel rigging and guy rope	7½%	
Galvanized iron rigging and guy rope	+12½%	

'California, Oregon, Nevada and Washington Discount: 5 points less than discount for Eastern territory.

Wyoming, New Mexico and Colorado: Discount 5 points less than discount for Eastern territory.

Arizona: Discount 10 points less than discount for Eastern territory.

Montana, Idaho and Utah: Discount 10 points less than discount for Eastern territory.

North Dakota, Nebraska, Kansas, Oklahoma and Texas: Discount 5 points less than discount for Eastern territory.

MANILA ROPE—For rope smaller than ¼-in. the price is ½ to 2c. extra; while for quantities amounting to less than 600 ft., there is an extra charge of 1c. The number of feet per pound for the various sizes is as follows: ¼-in., 8 ft.; ⅜-in., 6; ½-in., 4½; ⅝-in., 3½; ¾-in., 2 ft. 10 in.; 1-in., 2 ft. 4 in. Following is price per pound for ¼-in. and larger, in 1200-ft. coils:

Boston	**0 16½**	New Orleans	$0 18½
New York	.18½	Los Angeles	.18
Chicago	.18	Seattle	.18
Minneapolis	2.3½	St. Louis	.19½
San Francisc	.18	Montreal	.30
Atlanta	.21	Detroit	.19
Denver	.22	Baltimore	.18
Cincinnati	.21	Kansas City	.21
Dallas	**.21**	Birmingham	.20½
Philadelphia	.....		

EXPLOSIVES—Price per pound of dynamite in small lots:

	Gelatin 40%	Gelatin 60%
New York	$0.27	$0.295
Boston	.23	.25
Kansas City	.225	.25
Seattle	.165	.19
Chicago	.22	.25
Minneapolis	*.1917*	*.2123*
St. Louis	**.2225**	**.2475**
Denver	.2025	.2275
Dallas	*.225*	*.265*
Los Angeles	.17	.20
Atlanta	.23	.2575
Baltimore	.22	.23
Cincinnati	.225	.25
Montreal	.195	.235
Birmingham, *deli ered*	.16	.17
New Orleans	.195	.220
San Francisc	.1625	.1925
Philadelphia	.....	.....

CHEMICALS—Water and sewage treatment chemicals, spot shipments in carload lots, f. o. b. New York:

Sulphate of aluminum, in bags, per 100 lb.	$1.40@1.50
Sulphate of copper, in bbl., per 100 lb.	5.40@5.50
Soda ash, 58%, in bags, per 100 lb.	1.45@1.51
Chlorine, liquid, cylinders, 100 lb., per lb.	.09
Hypochlorite of lime (bleaching powder) in drums, per 100 lb.	2.20@2.30

FREIGHT RATES—On finished steel products in the Pittsburgh district, including plates, structural shapes, merchant steel, bars, pipe fittings, plain and galvanized wire nails, rivets, spikes, bolts, flat sheets (except planished), chains, etc., the following freight rates are effective in cents per 100 lb., in carloads of 36,000 lb.:

Baltimore	$0.31	Detroit	$0.29
Birmingham	.69	Kansas City	.735
Boston	.365	New Orleans	.515
Buffalo	.265	New York	.34
Chicago	.34	Pacific Coast (all rail)	1.34†
Cincinnati	.29	Philadelphia	.32
Cleveland	.215	St. Louis	.45
Denver	1.27*	St. Paul	.60

† Minimum carload, 40,000 lb.

* Minimum carload, 50,000 lb., structural steel only; **80,000 lb.**, for other iron or steel products.